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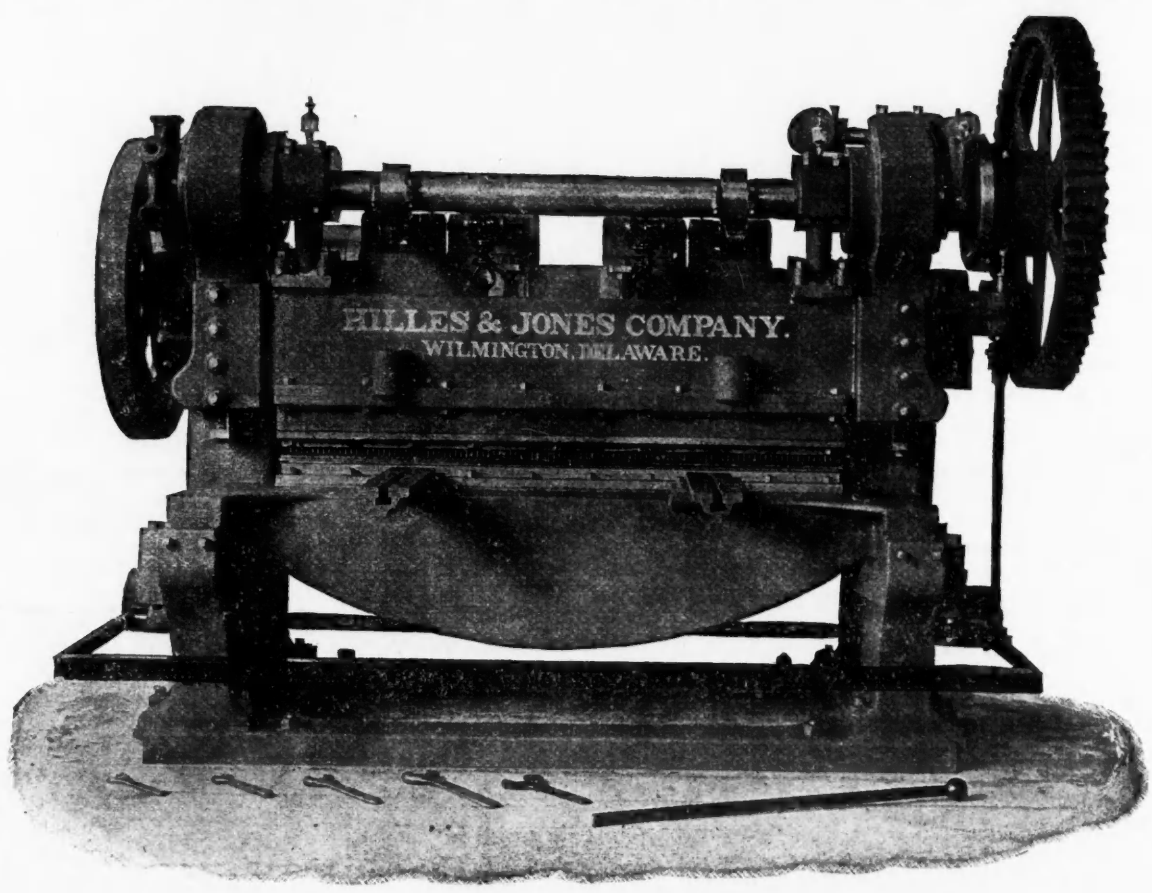
## Multiple Punch—Plate Planer.

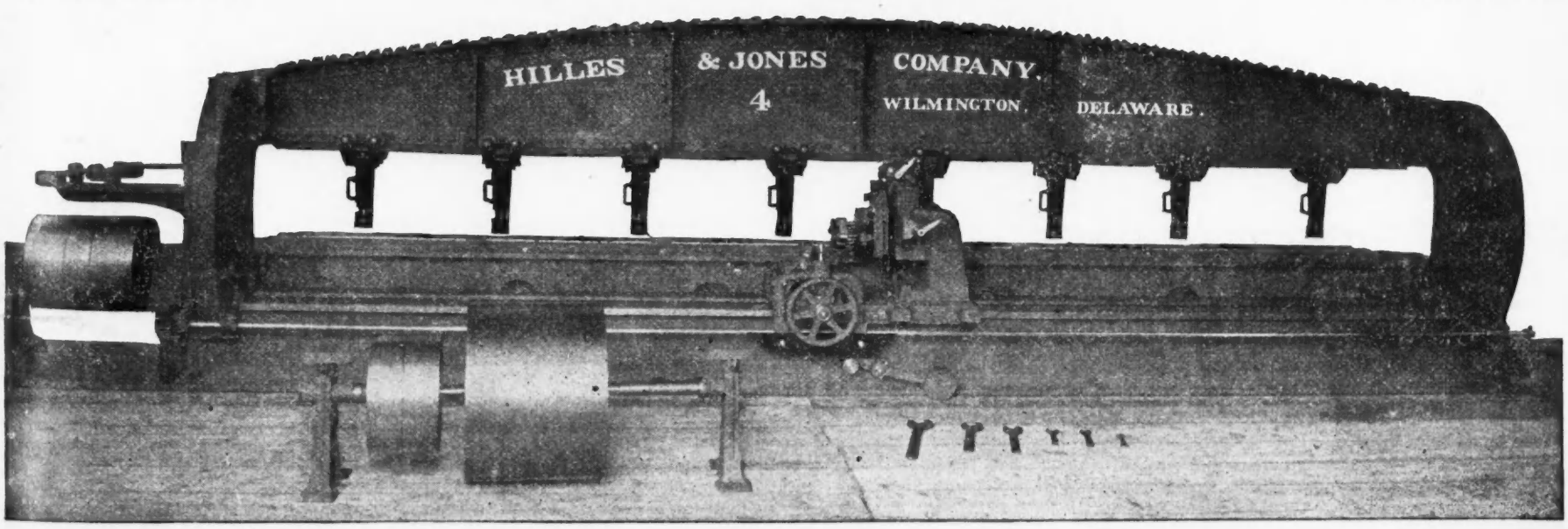
The first engraving on this page is of a multiple punch press designed for such work as bath boilers, tanks or any special work where a large number of holes are to be punched at one stroke. The machine shown in the photograph had 100 punches $\frac{5}{16}$" diameter, $\frac{5}{4}$" pitch, distance between housings being 78".

A feature of this machine especially worthy of note is that the die holders are secured to the die block and punch holders to the sliding head by means of bolts so that they can be removed and shear blocks, with knives attached, supplied, making the machine a regular gate shear. This means that the principle adopted on single punches or shears built by the same company has been applied to the gate shears and multiple punches, making the same tool either a multiple punch or gate shear. There is an adjustable automatic stop for bringing the sliding head to rest at any desired point of the stroke. The clutch is thrown into gear by means of a weight. The sliding head is counterbalanced and has shoes for taking up the wear. The arrangement of the punch holder and die holder is very convenient for changing to other pitches of holes. The machines can be built of almost any capacity required.




The second machine is by the same builders, the Hilles & Jones Co., of Wilmington, Del., and is a plate planer.

The principal difference between this and the ordinary design consists in the fact that there is a wrought-iron built-up clamping beam instead of the usual cast-iron one, with clamping screws. On the lower member of the beam there are eight little trolleys carrying inverted jacks. These are for use in clamping plates, and can be distributed at any point under the beam best suited for the work to be done. The vertical height between the table and the beam is 23", so that there is ample room for irregular shapes, keel plates, etc. There are three tools in the saddle, one of these having vertical feed of 6" or 7". The special features of plate planers previously constructed by this firm are retained in this; such as automatic shifting of the tools in advance of the shifting of the belts, tools cutting both ways, screw supported its entire length, etc.




Machines of this type have been built to plane 32 feet at one setting, and they can be built of any required capacity. They are also built to plane the ends of sheets at the same time.

## Columbian Exhibition Notes—XIII.

*Editorial Correspondence.*

The Fox Machine Company, of Grand Rapids, Mich., have in their space a full line of their universal trimmers for pattern makers' and wood workers' use—machines with which our readers are familiar. They also show two shapers—a 15" and a 30" machine, the distinctive feature of the former being the method of changing the stroke. This shaper was illustrated in our issue of April 20. The larger machine has for its distinctive feature the placing of the head at one side of the ram and slide, the latter being extended out over the platen in such a way that the ram is supported nearer the cut than is usually the case. This machine was illustrated and described in our issue of December 31, 1891. The Fox trimmer, though it is coming to be well known here, is yet too new to be very well known in foreign countries, and Mr. Fox reports that the interest taken in the trimmer and its work by foreign mechanics, and manufacturers especially, is very gratifying, the more so as this interest has, in a number of cases, manifested itself in the form of orders.

Warner & Swasey, of Cleveland, have several new tools in their exhibit, among them the automatic valve boring and tapping machine, Fig. 68 (page 2). This machine is for boring and tapping brass or iron valves. The valves to be operated upon are placed in chucks, of which there are three in the revolving disk seen at the top of the machine. This disk is part of a heavy cast sleeve which revolves and is properly indexed to bring the valves into position in line with the spindles. The machine is double-headed and carries in all four spindles, the two seen in front being for boring and facing while those at the back are for tapping. They are automatically advanced to the work by means of cams which are placed on the shaft that runs through the bed of the machine, this shaft also driving the spindles by means of suitable spur gears.

The same cutters both bore and face, the feed being automatically reduced when the latter operation begins. While the boring and facing are being done in front of the machine the tapping is being done at the rear, the tapping spindles being automatically reversed to run the taps out. At the same time the operator is changing the work in the uppermost chuck and the operation of the machine is thus continuous,

its capacity being, of course, very great—in fact 1,800 to 2,200 one-inch valves per day of 10 hours are readily obtainable. The machine is shown with one head uncovered, the other being similar to it, and the form of cover being such as to admit of the work being piled upon it.

Another new machine, by the same builders, is that shown in Fig. 69, which is a 24″ universal monitor lathe that is designed for doing the work upon the heavier sizes of iron and brass valves. The head has a friction clutch which gives a ratio between the two speeds suitable for boring and tapping, while the turret is mounted upon the cross-slide of what is in effect the carriage of an engine lathe, having the same movements, with screw and rod feed, both reversible; also automatic cross-feed in either direction. The turret has six 2½″ holes and has a hardened steel index. There is a stop which brings it exactly in line with the center when desired. On this machine the usual Vs for the carriage have been discarded, and the broad, flat surfaces of the top of the bed used for that purpose, the edges of the bed being square.

Among the other machines shown is one of Mr. Swasey's gear cutters, which attracts attention by cutting spur gears while the blank is continuously rotated, using the same cutter for gears having all different numbers of teeth so long as the pitch is the same. This machine was illustrated and described in our issue of November 13, 1890, which, though it shows that the machine is not entirely new, yet this being the first public exhibition of it, or of any machine cutting gears in a similar way, it forms one of the attractions of the machinery exhibit.

There is also a horizontal boring machine, of the Bement type, in which the uprights that support the yoke or the outer bearing for the boring bar have the unusual merit of being somewhere near as stiff and rigid laterally as they need to be when boring work of large diameter, and the cutter, which may be single-ended, is very near this bearing.

There is also a vertical milling machine which is especially adapted to die-sinking operations; revolving turret screw machines of various sizes, with and without back gears, friction heads, Parkhurst wire feed, etc.; monitor and forming lathes, the latter having a new adjustable slide and method of holding the tools; a hand lathe; double head key lathe, and a number of other tools specially designed for doing brass work—a line of tools of which this firm make a specialty; the whole forming a very interesting and comprehensive exhibit, to say nothing of their exhibit of telescopes and other astronomical instruments in the Manufactures Building of which we shall have more to say hereafter.

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The Hilles & Jones Company, of Wilmington, Del., have a very good exhibit of heavy punching, shearing and other kinds of sheet metal working machines, most of which are, however, familiar to our readers, having been illustrated and described in our columns. The exhibit includes a machine which may be used either as a punch or shear, and has 18″ depth of throat, can punch 3″ holes in 2″ steel or shear 4½″ square bars. It can be changed from punch to shear quickly, is driven by an attached engine and weighs, complete, 57,000 pounds.

There is a similar machine which is intended mainly for boiler work, this having a depth of throat of 60″ and a capacity to punch 1½″ holes in 1⅛″ steel. It is adapted to punching hand or flue holes and can be quickly changed to shear plates, for which it has a capacity up to 1⅛″ thick. It is driven by belt and has the gearing so arranged that the pulley shaft is at right angles with the crank-shaft, thus allowing the machine to be set nearer the wall than would otherwise be the case.

Forming a contrast to these machines one of the same type is shown which is the smallest geared machine built by the firm, its weight being 2,000 pounds; depth of throat, 5″; capacity ⅝″ holes in ½″ iron or to shear 3½″x½″ bars.

There is a single plate planing machine which uses two tools, cutting during both movements of the carriage, and having on the carriage an independent slide and support for a third tool with which the corners of a sheet may be beveled at the same time. This machine has a wrought beam overhead and supported by the lower flange of this beam are the screw jacks which hold the sheet while being operated upon, these being suspended upon rollers, so that they may be placed any desired distance apart and thus be used either for very short pieces or for taking out kinks or crooks in the sheet while it is being planed.

Plate straightening rolls such as we illustrated in our issue of April 14, 1892, are shown, the distinctive feature of these being in the arrangement of the first pair of rolls between which the sheet passes, these being vertically one over the other, so that the sheet can be pinched between them—so tightly pinched in fact that its length can be considerably increased if desired.

A double angle iron shear is shown which is driven by an attached engine and is capable of cutting angle iron or steel 7″x7″x1″ at any angle.

The exhibit also includes a vertical milling machine which in general design very much resembles a slotter, except that a very heavy spindle takes the place of the ram. This machine is designed for heavy work, such as is usually done upon the links and other parts of locomotives, samples of its work being shown upon the machine.

Nearly all the machines in this exhibit are shown in operation. In the machine shop previously mentioned the same company has a heavy double combined punch and shear which is driven by an electric motor placed on the frame of the machine.

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Among the machine tools that attract most attention are those of the Detrick & Harvey Machine Co., of Baltimore, Md.

Their exhibit consists of two of their side planers, one rated as 36″, the other 48″. Our readers are acquainted with the peculiar features of this tool, it having been illustrated in our issue of February 20, 1890. The machines shown here, however, have no outside standard.

Many of those who see the machines here have never before seen a planer with only one upright, an overhanging cross-rail, and with unlimited capacity at one side, and as the machines are shown planing cast iron, taking a heavy cut, much interest is shown in them.

Both machines have spiral driving gear (Sellers type), and one of them has the "supplemental rolling table," which consists of two I beams placed one above the other with rollers between them; these being placed upon cross-rails below and adjustable to any required distance from the machine. The top of the upper beam is just even with the platen and its office is to support the overhanging portion of work which would otherwise be in danger of tipping the platen from its bearings.

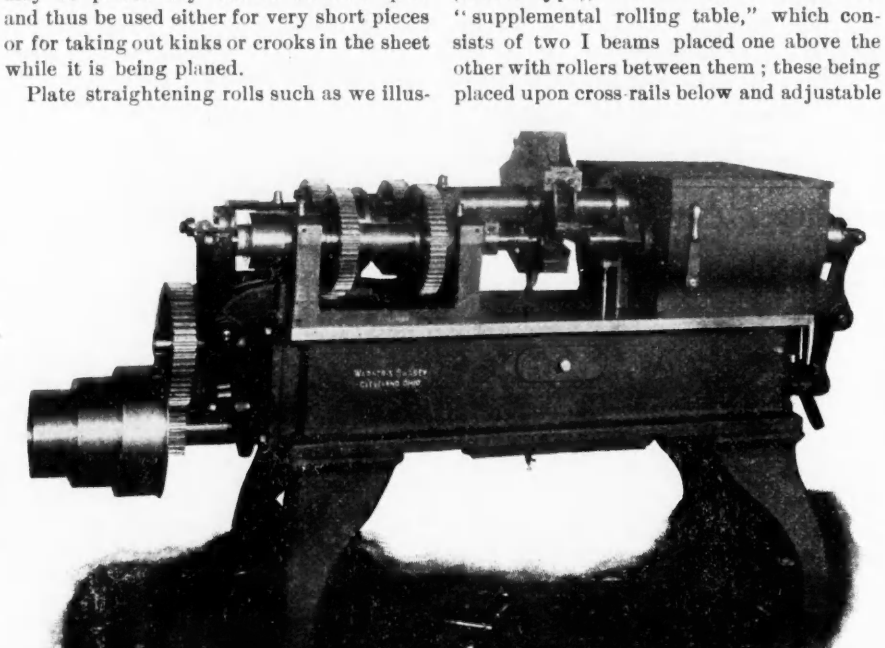

*Fig. 68.*

Valve Boring and Tapping Machine.

In these machines the countershaft is supported by brackets that are attached to the top of the upright, this being a special device adopted to avoid erecting over the exhibit a structure to support the ordinary countershafts. The plan works so well here, looks so neat, and possesses so many obvious advantages, especially where, as in this case, the machines are to stand under a traveling crane, that it will probably become a permanent feature of the machines.

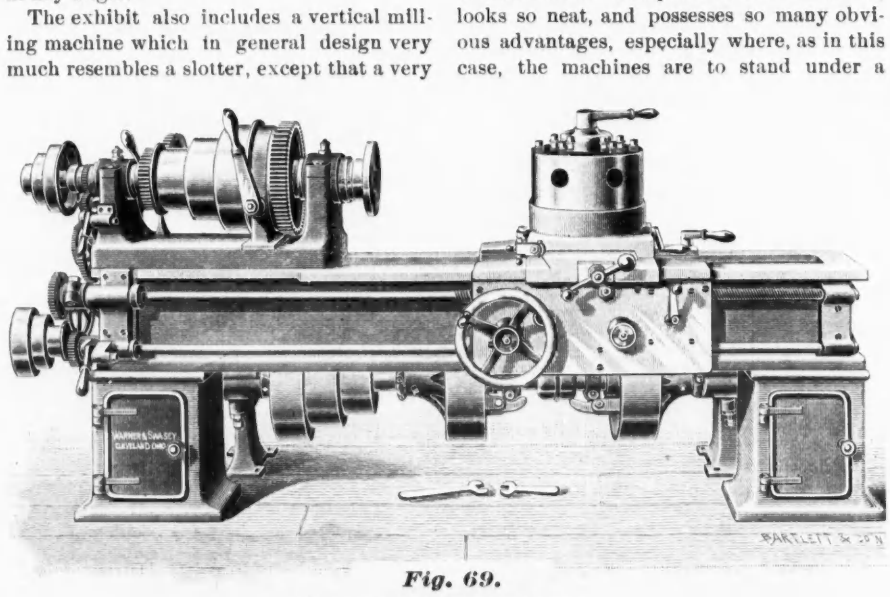

*Fig. 69.*

Universal Monitor Lathe.

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The Brown & Sharpe Mfg. Co. show in all about forty machine tools, which are too much crowded for the most advantageous display; this crowding being, I presume, thought less objectionable than to make a still further reduction in the numbers and in the representative character of the display.

As would be expected, the milling machine forms a prominent part of the exhibit, sixteen different types and sizes of this machine being shown, besides a number of gear cutters, which are a special form of milling machine. There are eight grinding machines of various forms, from the simplest cutter grinder to the most elaborate universal machine; six screw machines, including one of their automatics, and two (13″ and 16″) specimens of their new engine lathe, which we illustrated in our issue of August 11, 1892. The rest of the exhibit consists of chucking machines, horizontal and vertical, screw slotting machines, etc.

Among the milling machines there is a full line of the new design of universal machine illustrated and described in our issue of July 27, and in the most prominent portion of the space is the original universal milling machine, the first one built, and the prototype of all the universal milling machines that have been built, in this and other countries.

This machine, the first of its kind, was built in 1862, and was invented by Joseph R. Brown who patented it February 2, 1865. The machine was sold to the Providence Tool Company, and was used by them on tool work for government contracts during the war. When this concern passed into the hands of the Household Sewing Machine Company, the machine was purchased with other tools by A. B. Pitkin & Co., who sold it to parties in New York State. Again falling into the hands of machinery dealers, it was finally placed in the shop of Samuel Moore & Co., of Providence, who were using it in their business of manufacturing jewelers' supplies, when, the B. & S. Mfg. Co., hearing of it, exchanged a new machine for it, and it now occupies the place of honor at Chicago.

The machine as it stands embodies all the essential features of the most modern forms, and, in fact, is essentially the same as many built within the past few years. It shows that Mr. Brown had fully concieved the idea of the wonderfully ingenious yet simple dividing or spiral head for instance, and it is all there, complete as now made, except the covers for the miter gear and for the worm and wheel.

The tool maker who first ran the machine when it was new, Mr. Charles A. Eames, now of South Framingham, Mass., visited the Exhibition recently, and recognized the old machine as the friend of his youth.

The excuse, if any were needed, for going thus into particulars regarding this machine must be in the fact that it is probable that nearly every tool maker that has the least interest in his art must be interested in this, the machine that marks an epoch in tool making; that has been said to embody more intelligence than any other machine tool ever devised, and that certainly has done very much to stimulate and develop the habit of study among mechanics who are called upon to use it; possessing as it undoubtedly does some peculiar quality that seems constantly to invite investigation of the reasons why it performs its functions, and especially of the mathematical basis upon which they rest.

Not all the machines shown are in operation but one of those that is occasionally started up is a new automatic gear cutter which runs cuts through a blank for a spur gear wheel of 3 diametral pitch and 6″ face at the rate of 5″ per minute, finishing the tooth at a single cut, and it appears to do the work easily, this being a regularly attained rate of cutting in the B. & S. and other shops with this machine.

The cutter is run back fifty-seven times as fast as it is fed forward, and the indexing device is driven by independent belt from the counter in order that this function may be performed at a uniform and the maximum rate.

Among the other machines in the exhibit that attract special attention is the measuring machine, Fig. 70 (page 3). This machine is here shown publicly for the first time, three of them having been recently completed for use in the B. & S. shops. The machine consists essentially of a very heavy and massive bed (extending far below the top of the bench where the molding is seen at the left), the top of this bed carrying two movable heads which are fitted to the broad flat surface and gibbed at the sides. The larger head at the left carries a bar which is for the most part cylindrical in form, but between the two bearings is enlarged and has

the upper half slabbed off as shown, the flat surface thus formed having attached to it a scale 8″ long, and having at its inner edge graduations so fine as to be wholly invisible to any but good eyes with a good light. The object of forming the bar in this way is to get these graduations into the center line passing through the center of the contact points, so that any deflection which may take place in any part of the machine will have the least possible effect upon the accuracy of the measurements. Above this scale is a microscope, with micrometer eye piece, for reading the graduations, this microscope being mounted upon a slide parallel to the scale and of sufficient length to admit of repeating the length of the scale by moving the head, so that 16″ may be measured by it.

In the smaller head at the right, which is also movable, is a micrometer screw, the slide above this being merely to support a magnifying glass to aid the accurate reading of the micrometer graduations. These micrometer graduations are in turn read by a vernier scale, making the value of the graduations equal .00001″. In this machine the main dependence is placed upon the graduated scale before referred to, the micrometer screw being depended upon only for very short distances —not necessarily more than $\frac{1}{16}$″ probably.

The cone at the back is a device adopted at the shop to concentrate the light from a window upon the graduations, and thus enable them to be clearly seen in the microscope. No special devices are employed for securing uniformity of contact, but the sense of touch is depended upon entirely for that. As some form of indicator is by many considered a necessity for securing uniform contact, and thus avoiding unequal strain and yielding, as between different measurements by the same or different workmen, it may be of some interest to give the results of a test of this matter made with the machine at Chicago. Taking a half-inch standard plug, lapped smooth, the measuring points were brought together upon it until there was such a contact when passing the plug through between the points as I considered right for gauging.

The micrometer graduations were then read, the relative positions of the heads having been purposely made such that the reading did not start from 0, and consequently had no direct reference to the actual size of the plug. Removing the plug the micrometer screw was run back a considerable distance, and without reading the graduations again brought up until what I thought was the same contact as before had been again secured; upon looking at the scale it read precisely the same as before. This was again repeated with the same result, after which two more trials indicated one graduation or .00001″ larger, this being more than likely due to expansion of the plug by increase of temperature due to handling.

Messrs. Parks and Vial, of the B. & S. Company, then made the same test, each repeating it a number of times and getting in most instances the same reading, and the extreme variation of all the tests was only .00002″. Of course these tests, which were not made under the most advantageous circumstances by any means, showed only one thing, *i. e.*, that the sense of touch will detect very small differences of magnitude, for nothing can be much more certain than that if the plug had been, for instance, .00001″ larger one way than the other it would not have happened that the same graduations would have matched when, by the sense of touch, we determined that the original contact had been restored. It also seemed to show, however, that the variation between the measurements of three different persons may, and probably in most cases would, vary very little when using the same machine, and that machine specially designed to resist the tendency to yielding.

On a bench within the space is to be seen the arrangement of gearing shown by Fig. 71, this being called the "College Gear Model." The hand-wheel, when turned, rotates all the gear wheels seen, the variety of these being sufficient to enable a pretty thorough study of the action of gearing to be made. At the end furthest from the hand-wheel are three helical gears as

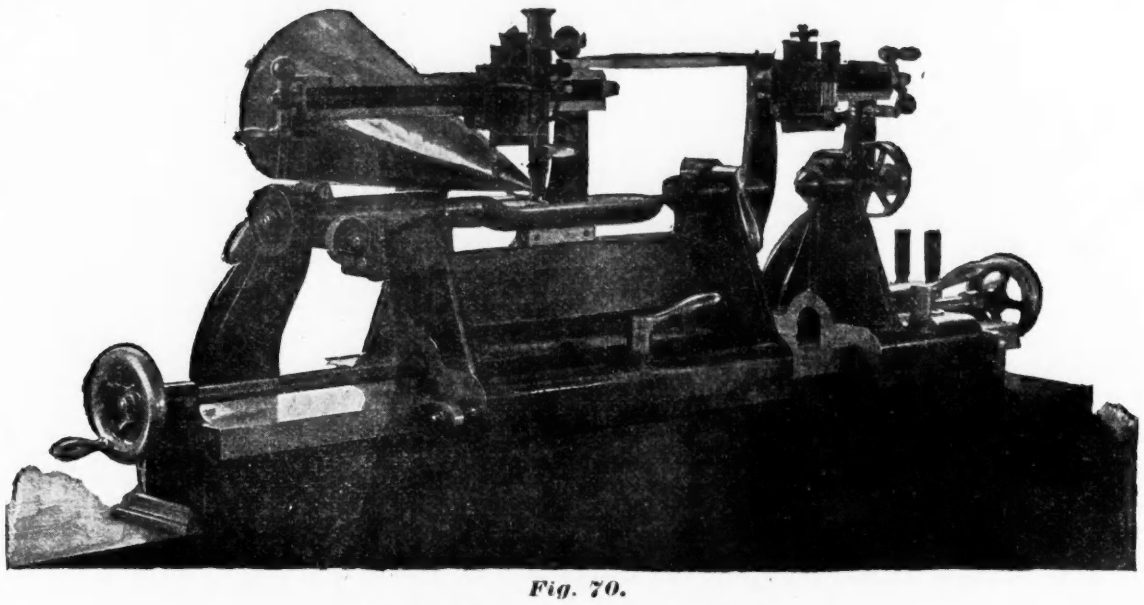


*Fig. 70.*

Brown & Sharpe Measuring Machine.

shown, the lower one of these being so placed that it engages with either of two racks, one of them having its teeth at an angle of 45° (the angle of the spiral), while the other has them square across. Below this gear there is a plane surface having four square grooves in it; one of these being in line with the stud on which the gear is placed, another at right angles to it, and the two others at an angle of 45°; all these grooves intersecting at the center of the plane surface directly beneath the center line and center of face of the helical gear. The 45° rack will pass through either of the first mentioned grooves when the gear is turned, while the rack with square teeth will pass through either of the 45° grooves, so that with the same wheel the worm action and the spiral gear such as is used on the Sellers planer can be had. These helical gears can be changed about, or reversed end

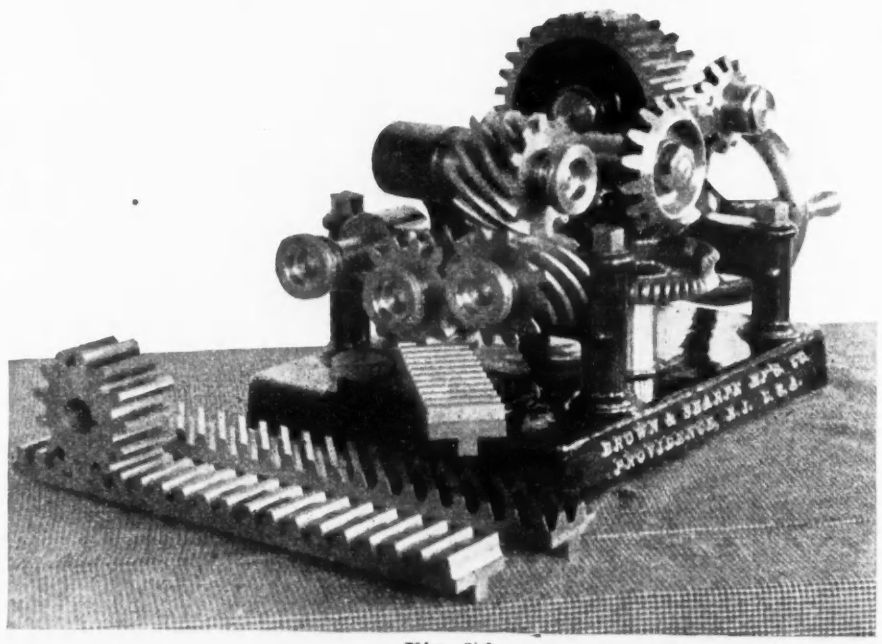


*Fig. 71.*

College Gear Model.

for end, and all the gears of the entire train work with remarkable smoothness, and yet very close. Much of the science of these helical gears is given in our issue of August 28, 1890.

There are numerous show cases filled with some 1,500 small tools, and milling cutters, no two of these being alike. There is one solid steel, spiral mill that is 6″ diameter, 24″ long. It has a 2″ hole through it, with two chambers, *i. e.*, there is a bearing upon the arbor at the middle of its length, as well as at the ends. The cutting edges of this cutter are not continuous from end to end, but are intercepted at intervals by flat notches that are cut out of the edge, these being cleared. It is found that such a cutter works much better and more freely than where the cutting edges are continuous.

Many curious shaped cutters are shown, and some specimens of the work done by them; among the latter being two pieces of cast-iron, formed as shown in Fig. 72. The teeth in these are of the form indicated, and when placed together fit closely and

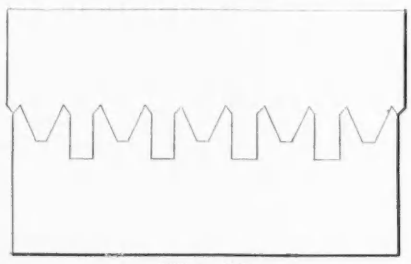


*Fig. 72.*

well, no matter which way the top piece is turned. The pieces can also be separated and shifted endwise so as to bring different teeth into engagement, the fit being still an excellent one, and the job shows a high state of perfection in such work, finished as it is by a gang of cutters at a single cut.

A hob is shown that is 7¾″ diameter, 2″ pitch, 8″ long, this being made for hobbing a worm gear.

Micrometer calipers of all forms are shown, there being 49 distinct kinds and sizes of these with capacities ranging from ⅛″ to 12″.

Among the scales, squares, gauges, etc., shown by Darling, Brown & Sharpe, are a steel straight-edge 10 feet long, and a square scale of the same length, this having graduations on two sides.

In the same space is the exhibit of the J. M. Carpenter Tap and Die Company, of Pawtucket, R. I., which consists of a full line of their well-known screw threading devices for use by hand or in machines.

F. J. M.

We unintentionally omitted to state that the cold metal sawing machine built by M. E. Chouanard, Aux Forges de Vulcan, 3 Rue St. Denis, Paris, and illustrated in our issue of August 10th, is exhibited in the French section of Machinery Hall at Chicago.

## A Comparison of the Thompson, Tabor and Crosby Indicators at about Three Hundred Revolutions.

By Edward J. Willis.

The object of a test conducted by the writer was to ascertain if there were any radical differences in the records of these instruments at moderately high speeds. The instruments used were not specially provided by the manufacturers but were those usually supplied to the public. They were carefully examined before the test and found to be in good order. The engine selected for the test was an eight by twelve Ball engine running an Edison dynamo. In order to obtain symmetry of position four instruments were used, one Thompson, one Tabor and two Crosby indicators. These were connected with the head end of the above mentioned engine, care being taken to give each instrument the same size, length and form of pipe. By this construction each indicator had about nine inches of ½-inch pipe and two elbows between it and the cylinder. An iron brumbo pulley carried a hard drawn wire which was stretched tight by four spiral springs. To this wire the four drums were connected by four short cords of equal length cut from the same hank and making the same number of turns. The springs of the drums were adjusted to as nearly the same tension as was possible. A special apparatus was made for the simultaneous application and release of all four pencils. The results were as follows:

| | Indicator. | Boiler Gauge. | Revolutions. | Spring. | Mean Effective Pressure. | Horse-Power. | Remarks. |
|---|---|---|---|---|---|---|---|
| Set No. 1. | Thompson... | 80 | 293 | 80 | 22 11 | $9\frac{3}{10}$ | Good card. |
| | Tabor.. .... | " | " | " | 21 56 | $9\frac{7}{10}$ | " " |
| | Crosby No. 5. | " | " | " | 21 88 | $9\frac{5}{10}$ | " " |
| | Crosby No 7. | " | " | " | 21 69 | $9\frac{7}{10}$ | " " |
| Set No. 2. | Thompson .. | 90 | 295 | 80 | 25 24 | $11\frac{3}{10}$ | Good card. |
| | Tabor. .... | " | " | " | 25 24 | $11\frac{3}{10}$ | " " |
| | Crosby No. 5. | " | " | " | 24 98 | $11\frac{2}{10}$ | " " |
| | Crosby No. 7. | " | " | " | 24 81 | $11\frac{1}{10}$ | " " |
| Set No. 3. | Thompson... | 75 | 295 | 50 | 17 24 | $7\frac{7}{10}$ | Good card. |
| | Tabor.. .... | " | " | 60 | 17 61 | $7\frac{9}{10}$ | " " |
| | Crosby No. 5. | " | " | " | 18 33 | $8\frac{2}{10}$ | Double & bad. |
| | Crosby No. 7. | " | " | " | 18 43 | $8\frac{2}{10}$ | Good card. |
| Set No. 4. | Thompson... | 75 | 295 | 50 | 22 84 | $10\frac{3}{10}$ | Good card. |
| | Tabor.. | " | " | 60 | 21 63 | $9\frac{6}{10}$ | " " |
| | Crosby No. 5. | " | " | " | 22 38 | $10\frac{0}{10}$ | " " |
| | Crosby No. 7. | " | " | " | 23.25 | $10\frac{6}{10}$ | " " |

All the cards taken are given above, and none were cast aside to make results more consistent. In appearance they look very much as if they were taken with the same instrument. It is to be noted that only once did the apparatus for pencil application fail to work neatly. The variations in horse power as given by the different indicators is, in the opinion of the writer, easily accounted for by the various unavoidable errors likely, even when using duplicate instruments, such as planimeter inaccuracies and slight differences in the lubrication of the indicator pistons. After the test each

set of springs were tested simultaneously by steam against a mercury column. The column is of careful construction and temperature and other corrections properly applied. The spring errors thus found did not, in any instance, exceed 3 per cent. and the results given above have been so corrected. The writer usually finds springs slightly soft. This is probably due to the fact that the makers prefer an error of one or two per cent. in favor of rather than against the horse-power of an engine. It would appear from these experiments that, if care were taken to see that the drum motion were as it should be, the relative advantages and disadvantages of these instruments would be mainly ones of facility rather than of accuracy.

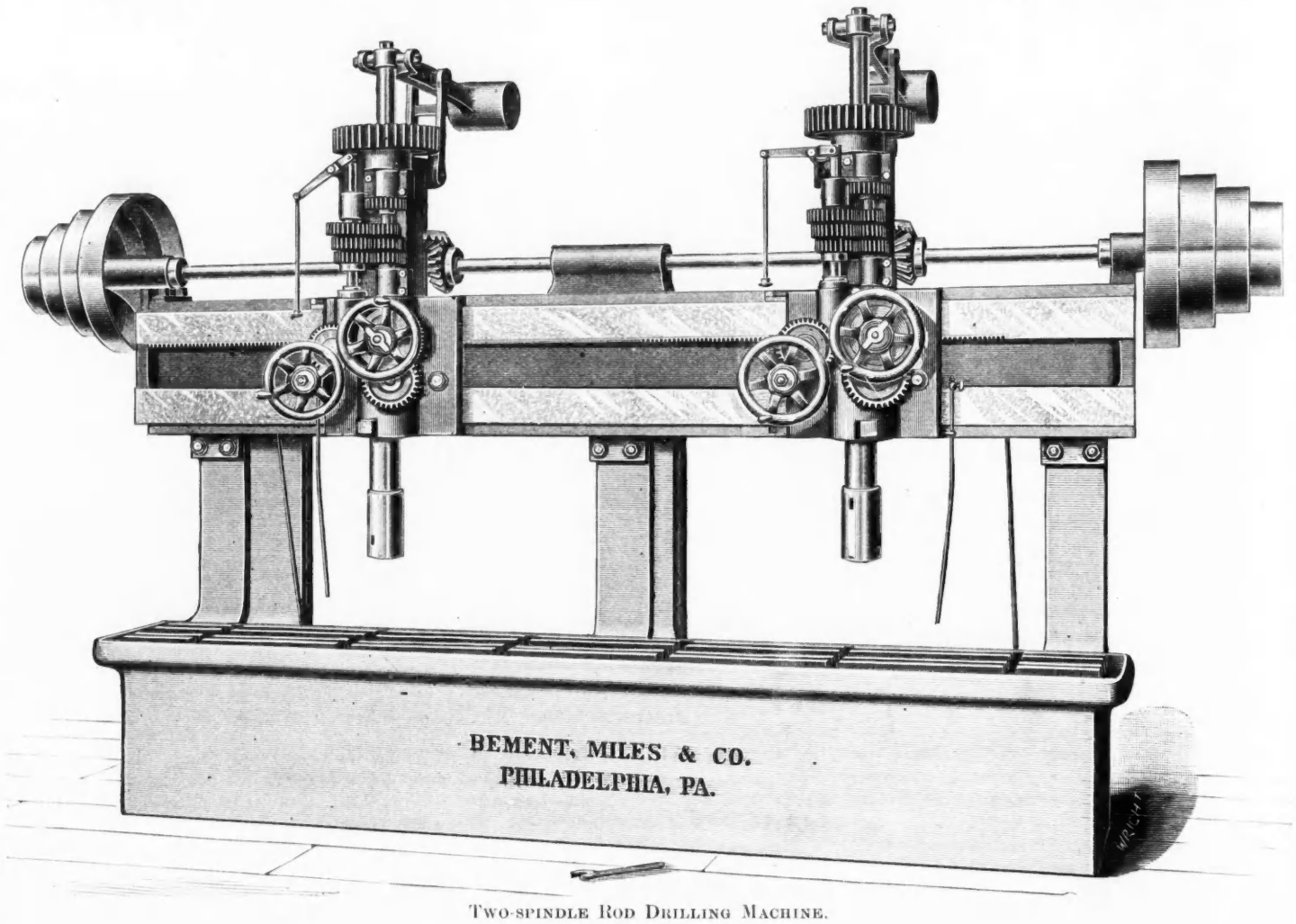
### Multiple Spindle Drilling and Boring Machines.

We illustrate on this page two types of vertical, multiple spindle drilling and boring machines, intended especially for locomotive work, but adapted equally well, of course, to any work of similar character.

The first of these is a two-spindle machine, each of the spindles being driven separately, so that they may be given each the proper speed and be handled separately, this machine being designed especially for drilling at one time the two ends of locomotive connecting and parallel rods.

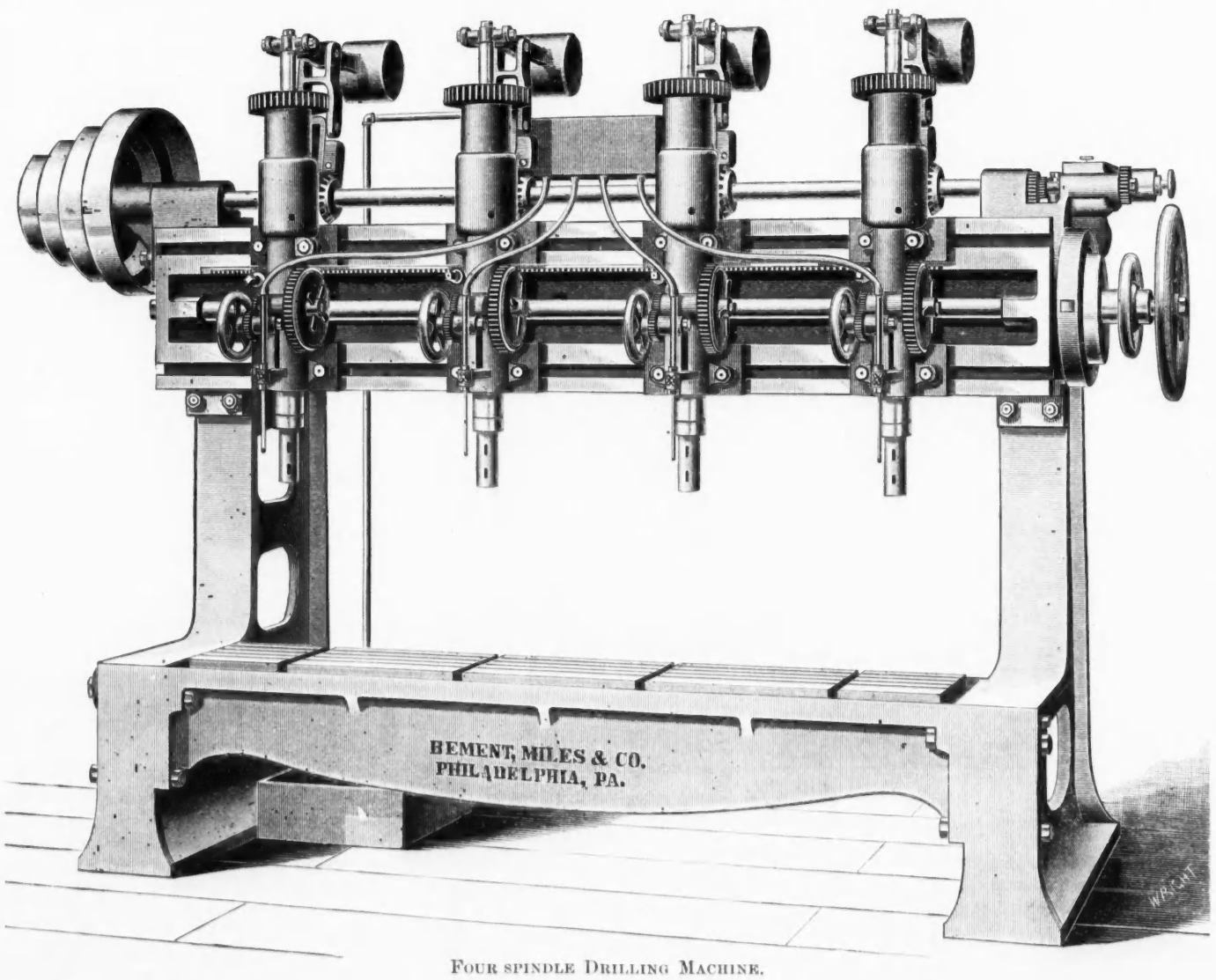
The spindles are of steel, 4⅜″ diameter, and the power and strength of the machine is ample for drilling two 3½″ holes from the solid metal, or boring two 9″ holes. There are three rates of feed through a range of 15½″, with quick return and lever counterbalance. Lateral adjustment is by rack and pinion, and the spindles may be placed any distance apart from 3 to 10 feet.

Within the cross-rail is formed a tank from which lubricant is supplied to the tools, this lubricant then passing to a tank in the base of the machine from which it is again pumped to the upper tank by two attached pumps which do not appear.




Two-spindle Rod Drilling Machine.

The second machine is intended for general locomotive and similar work, and will drill four holes at a time up to 1½″ diameter. The spindles have four speeds, two rates of feed, quick return motion, lever counterbalance and lateral adjustment on the cross-rail by rack and pinion motion. The shortest distance between centers of holes drilled is 12″, and the usual distance between uprights is 5 feet 10″, which, however, may be made any required amount. More spindles can also be added should the character of the work to be done seem to make their employment advisable. Both machines are made by Bement, Miles & Co., Philadelphia, Pa.




Four spindle Drilling Machine.

### Always Breaks the Crystal.

"I have been told," said Mr. Dubois, watching the great steam hammer in the rolling-mill, "that a good hammerman can break the crystal of a watch with that 30-ton hammer."

"Yes, sir," said the hammerman, "it can be done."

"I should like to see it," said Mr. Dubois eagerly, feeling in his watch pocket.

"I can do it, sir," replied the man.

"And will you?" replied Mr. Dubois, drawing out his watch. "Come, I am anxious to see it tried."

He laid his watch on the great anvil plate. The hammer rose to its full height, and the next instant all its ponderous weight, with a crushing force which shook the ground for an acre round, came down on the watch.

"There, sir," said the hammerman, "if you don't believe that crystal is broken, just step down and you can see it sticking to the hammer."

Mr. Dubois swallowed a whole mouthful of lumps and gasped before he could speak.

"But I forgot to say," he exclaimed, "that it was to break the crystal without injuring the watch."

"Oh, yes," said the hammerman, "Yes, I know. I have heard that rubbish myself, but it's all gammon. I don't believe it. But you can break the crystal any time."—*London Tit Bits.*

It is announced by the Academy of Sciences in Turin that entries for the ninth Bressa prize of 10,416 francs, for which men of science and inventors of all nations are free to compete, will close on December 31, 1894. The prize will be given to whoever has, in the judgment of the academy, made the most important and useful discovery, or published the most profound work in the domain of the physical and experimental sciences, natural history, pure and applied mathematics, chemistry, physiology and pathology, geology, history, geography and statistics, between January 1, 1894, and the date mentioned. Any one wishing to compete must send his printed work to the president of the academy. Manuscripts will not be accepted.

## U. S. Revenue Steamer "William Windom."

With this we give illustrations of the engines and boilers for the U. S. revenue steamer "William Windom" (twin screw), now in course of construction at the Iowa Iron Works, of Dubuque, Iowa. The steel plates for her hull were made by the Carbon Steel Co., of Pittsburgh, Pa.

The propelling engines are right and left, placed in a common water-tight compartment. These engines are of the vertical, inverted cylinder, direct acting, triple-expansion type, each with a high-pressure cylinder 11⅞ inches, an intermediate pressure cylinder 16½ inches, and a low-pressure cylinder 26½ inches in diameter; the stroke of all pistons is 24 inches. The collective indicated horse-power of propelling, air-pump, and circulating pump engines will be about 800 when the main engines are making 175 revolutions per minute. The high-pressure cylinder of each engine is placed forward.

The piston rods are of forged steel 2⅝ inches diameter, excepting at the ends where they will be 2¼ inches diameter over threads. The collar at piston end is 3¼ inches diameter and ½ inch thick, and recessed in the piston. The crosshead end of the piston rod is forged so as to form the crosshead slipper and the bearing for the crosshead journal, the latter being carried by the connecting rod. The butt brass is ½ inch thick, and the cap brass forms the binder. The binder bolts are 1½ inches diameter.

The slipper is 10 inches long and 8 inches wide, 1 inch thick at the sides, increasing to 1½ inches at the center; it is lined with transverse bars of white metal.

The crosshead guide is of cast iron fitted for water circulation. The connecting rods with their bolts are of forged steel. Length of connecting rod 60 inches between centers, turned to 2½ inches in diameter at the small end, and 3¼ inches at the large end. Bolts 1½ inches diameter.

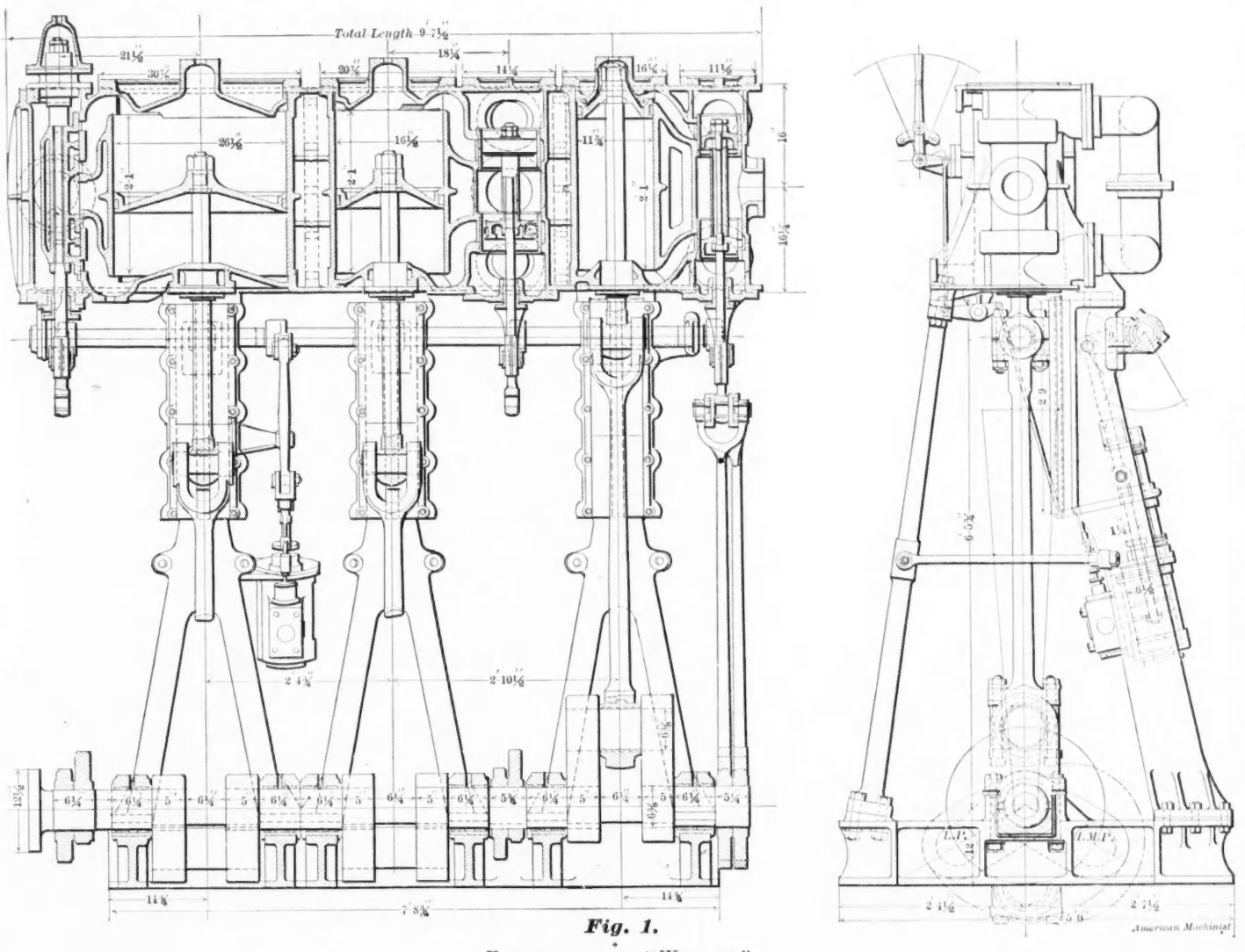



***Fig. 1.***

ENGINES OF THE "WINDOM."

The valve gear is of the Stephenson type, with double bar links. All valves are worked direct. The valve gear is so adjusted that the main cut off in full gear for both ends of each cylinder is about 0.7 stroke. There are piston valves for the high-pressure and intermediate cylinders, and slide valves for the low-pressure cylinders. The piston valve consists of two hollow pistons, made to fit the valve liners accurately without packing rings for the H. P. valves, and with packing rings in I. P. chests. The diameter of the H. P. valve is 5¾ inches, and the I. P. valve is 8½ inches diameter.

The hollow pistons of each valve are separated by steel distance pieces of such a length as to make the steam and exhaust laps for the H. P. and I. P. valves as follows: Steam lap at top, 1 inch; at bottom, $\frac{9}{32}$ inch; exhaust lap, top, minus $\frac{11}{32}$ inch; bottom, minus $\frac{5}{64}$ inch. The steam ports of the high and intermediate pressure cylinders are 1½ inches wide, and the diagonal bridges take up not more than one-quarter of the total port area. The low-pressure cylinder has a double ported cast iron slide valve; steam lap on top, 1 inch; bottom, 1 inch; exhaust lap, top $\frac{7}{32}$ inch; bottom, $\frac{1}{2}$ inch; steam ports, 1½ inches wide.

A 5½-inch pipe leads from each end of H. P. valve chest to the corresponding end of the I. P. valve chest, with a connecting pipe; a 7-inch pipe leads from the I. P. exhaust to L. P. chest, and a 9-inch pipe from the L. P. exhaust to the condenser.

The crank-shaft journals at each side of the cranks are 6¼ inches diameter and 6¼ inches long. The crank-pins are 6¼ inches diameter and 6¼ inches long. The thrust shafts are 6¼ inches diameter. Each shaft has eight thrust collars 1¼ inches thick, with spaces of 2 inches, the collars are 9¼ inches outside diameter.

The main condenser is made cylindrical, 3 feet 6 inches internal diameter, made of wrought iron $\frac{5}{16}$ inch thick, with welded seams. It contains 1,590 seamless tubes ⅝ inch outside diameter, No. 18 B. W. G. in thickness, tinned outside and inside. The tubes are 5 feet 1½ inches long between tube sheets The cooling surface is about 1,333 square feet, measured on outside of tubes.

The air and circulating pumps are of the combined type and independent of the main engines.

Steam is supplied by one double-ended cylindrical Scotch boiler, shown in Fig. 2. Outside diameter, 12 feet $2\frac{3}{32}$ inches; length over heads 16 feet 4 inches; length of grate, 6 feet. Total heating surface, 2,415 square feet; grate surface, 76 square feet; ratio of heating to grate surface, 31.78; thickness of boiler shell, $1\frac{3}{64}$ inches. Boiler pressure, 160 pounds.

There is also an auxiliary boiler of the description known as the Towne patent as shown in Fig. 3. Its grate surface is 9.4 square feet; total heating surface, 259.6 square feet. Its total height to top of uptake is 5 feet 4 inches, including ash pit, and its outside dimensions, exclusive of clothing, are 4 feet 3 inches by 3 feet 8 inches. The drum is 18 inches outside diameter, 4 feet 8 inches long and $\frac{5}{16}$ inch thick.

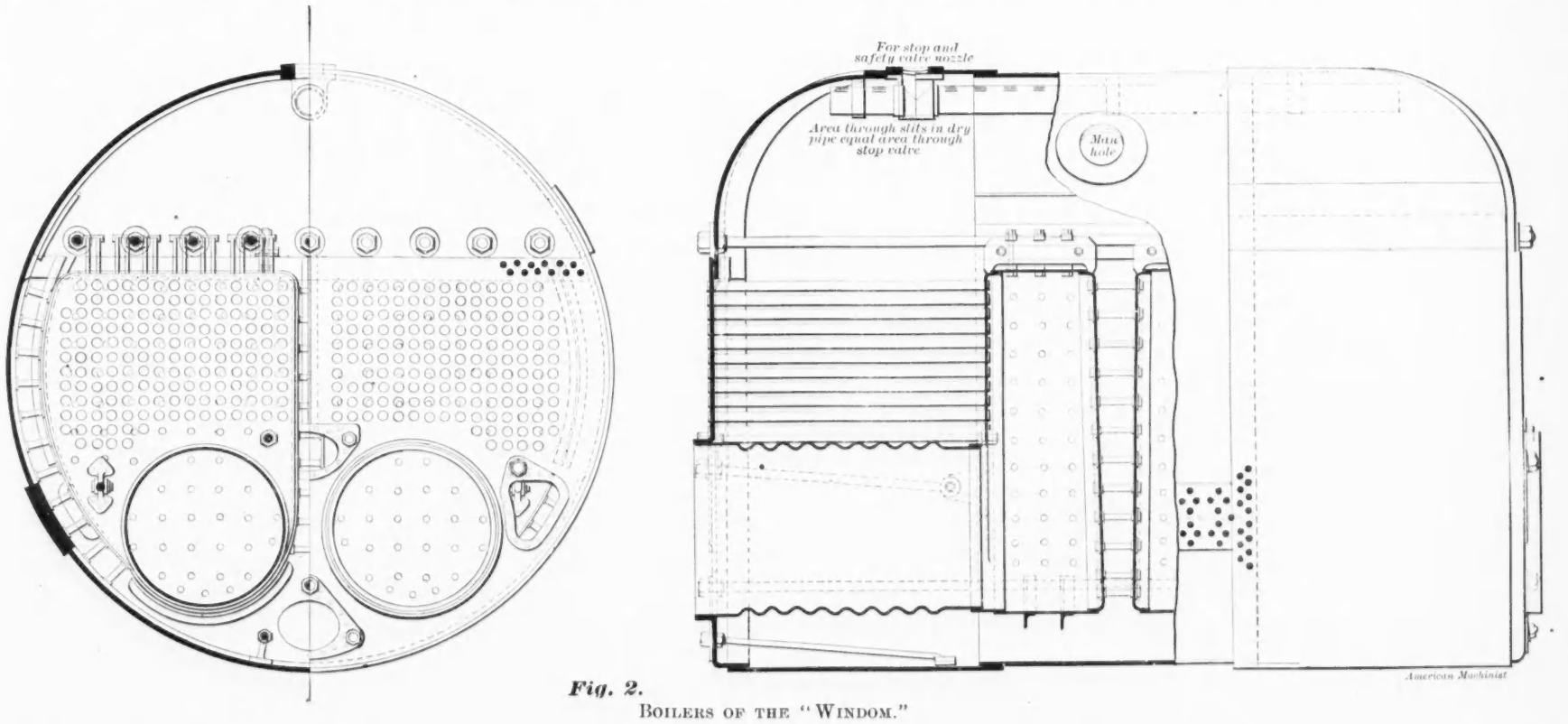

For stop and safety valve nozzle
Area through slits in dry pipe equal area through stop valve
Man hole
American Machinist

***Fig. 2.***

BOILERS OF THE "WINDOM."

The principal dimensions of the hull are:

| | |
|---|---|
| Length over all | 170 feet 8 inches. |
| Length extreme on water line | 160 feet. |
| Breadth of beam molded | 27 feet. |
| Breadth of beam extreme | 27 feet 1½ inches. |
| Depth of hold amidships at dead flat frame from top of floor stringer plate to top of main deck beam | 13 feet 5 inches. |
| Draught, mean, with 50 tons of coal in bunkers | 6 feet 6 inches. |
| Displacement at 6 feet 6 inches mean draught | 412 tons. |

## LETTERS FROM PRACTICAL MEN.

### Thermal Storage.

*Editor American Machinist:*

Thermal storage is the latest thing in steam engineering to which attention is now being directed. The object of this idea is to generate heat by means of a small boiler worked long hours, and store such heat in a large mass of water from which it is to be withdrawn in a few hours to work a steam engine very much larger than could be worked by the little boiler direct. The system resolves itself actually into a combination of a small furnace with a large water capacity and depends for its success upon an insulation or protection against loss by radiation of the heat stored in the water. Of course the only way in which heat can be thus stored for use in steam engines is to raise the temperature of the water above that at which the engine is to work. The heat available for power is then that which is contained in the water between the limits of temperature fluctuation. Assuming the engine works at 100 pounds gauge pressure the temperature of this lower limit is about 337° F. Assuming that the boiler can be worked as high as 200 pounds the temperature of higher limit is thus about 387°. The range is 50° and the stored heat available is this 50° or say 50 units of heat in each pound of stored water, for there is no question of latent heat—it is only very hot water. It thus appears that our steam boiler must be one capable of standing a high pressure. This subject strongly reminds me of the time when I first began to take a special interest in American practice. There was a proposal made by some paper about filling boilers with hot water for purposes of the hydraulic test which, it was thus argued, would be equivalent to a steam test as regards heat and yet possess the safety of the hydraulic test in freedom from explosion. The water was to be as hot as steam would be at the proposed working pressure. The AMERICAN MACHINIST pointed out editorially the fallacy of the argument, and showed how you could not have hot water in a boiler without the corresponding pressure, and was thereupon called a "*Mechanical Ananias*" by its Western contemporary. Needless to say the AMERICAN MACHINIST was correct, and, in thermal storage, the maximum limit of temperature defines the pressure to which the small boiler will be exposed. The cylinders in which the hot water is to be stored can be very plain structures with hemispherical ends, and no stays, and as they will not be exposed to fire heat there will be no danger of hard incrustation.

The little boiler can do what it pleases in the way of priming, and as it will always be fed with clean water it also will be fairly safe. If it primes the priming passes simply to the store. With water impregnated by carbonate of lime this salt deposits when heat has driven off the excess of carbonic acid gas in the water. Sulphate of lime is generally understood not to be deposited at a less temperature than 400° F. Hence the term permanent hardness. If we suppose a set of storage tanks heated to 400° by means of steam from a small boiler we should find them filled with pure water, the lime salts having all deposited. If arranged in series so that the water had time to deposit entirely before it reached the last of the series, and this last tank were used as the source of feed to the boiler, we should be able ever after to keep the boiler free of scale simply by introducing the fresh feed into one end of the set and drawing the boiler feed from the other end, thereby securing also a circulation throughout the whole set. One of the concurrent advantages claimed for storage is the ability to utilize the heat developed by the continuous combustion of house refuse. Refuse destructors should work continuously. The heat thus produced can only be used intermittently and to do this storage is necessary. It amounts to this: fuel is given or obtained at low cost; it will therefore pay to spend money to save the heat thus cheaply bought. Assuming 50 units of heat to be storable in each pound of water we can very soon figure on the amount of storage capacity required for a given power. We know what a certain make of steam engine consumes in steam per hour, and will take this hourly consumption at 18 pounds of steam at 100 pounds gauge pressure. The thermal store has only to yield as the latent heat of evaporation. This is 875 units very nearly, from which it follows that each pound of steam drawn from the store will exhaust the storage of 17½ pounds of water. In other words, 17½ pounds of water lose 50° of heat in order to produce 1 pound of steam at 100 pounds gauge pressure. But our engine uses 18 pounds of steam per hour for each horse-power and $17\frac{1}{2} \times 18 = 315$ pounds of water per hour to be exhausted of surplus heat, or about 38 gallons, or say 5 cubic feet. It follows that to work a steam engine for 8 hours at 50 horse-power we must store 2,000 cubic feet of hot water. This corresponds with 286 feet of length of cylinders 3 feet diameter. Any other installation can similarly be figured out, but the foregoing figures will be sufficient to show that thermal storage is a matter not to be too lightly entered upon, for it necessitates an immense bulk of water to fill ordinary conditions.

Stratford-on-Avon, England. W. S.

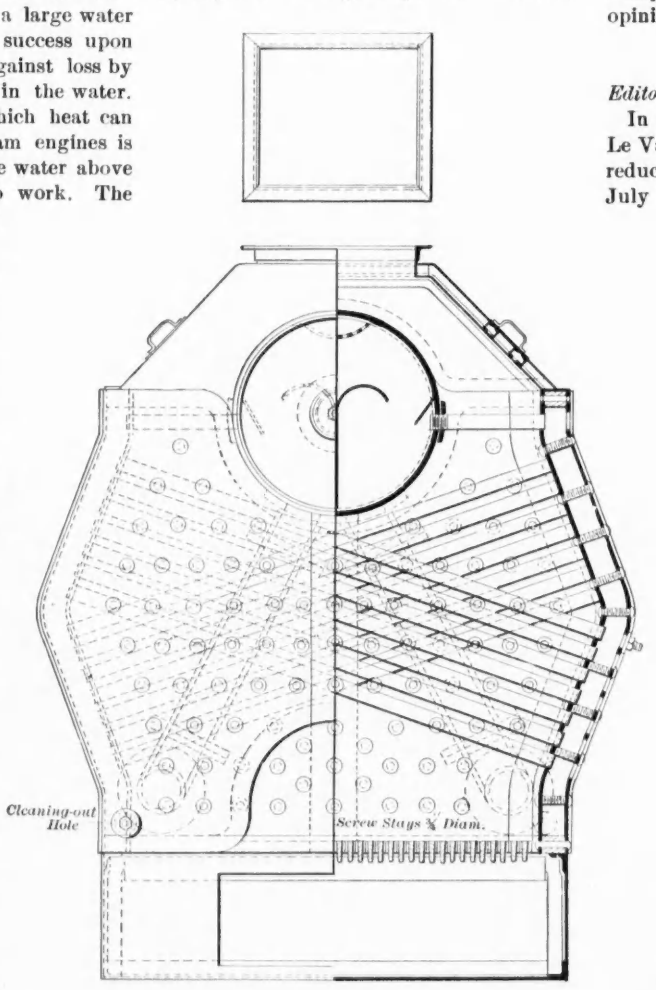



***Fig. 3.***

BOILERS OF THE "WINDOM."

### Hand-wheel Lunacy.

*Editor American Machinist:*

In looking over the AMERICAN MACHINIST I notice an example of so-called "hand-wheel lunacy" in the shape of a bar handle with a ball at each end; the place where this is used is on the vertical feed screw of a planer, and, to my mind, the handle described is the right thing in the right place.

I have used a great many planers of different makes and for a good many years, and never saw anything for the place that, all things considered, was so handy; in fact, I have taken off hand-wheels and cranks and replaced them with this same instance of "lunacy." If any one using a planer will change the crank or wheel for this kind of handle and use it one month, I am sure he will not willingly change back.

The critic says continuous rotary motion is impossible; I differ. Just put the palm of the open hand on top of one of the balls, bear down a little and turn, and you will get continuous rotary motion. The end balls should be at least 1¾" in diameter on the smallest machine and larger on larger tools, the center ball somewhat smaller.

As to hand-wheels, I prefer them to be conspicuous by their absence. This is the opinion of ONE CRANK.

### Reducing Motions.

*Editor American Machinist:*

In your issue of the 10th inst. Mr. B. Le Van writes that the pendulum of the reducing motion shown in your issue of July the 20th, has a variable length, *and to make the motion more correct, the slot should be in the piece attached to the crosshead, thus giving the pendulum a constant length*, as shown by Mr. B. Le Van; this is true if a pin is used to give the indicator drum motion, but is not true if a triangular piece is used, as shown by me in your paper of the 20th of July.

I said approximately correct because of the elasticity of the drum cord, and because when in motion the cord is not always moving in a horizontal plane (in the case of a horizontal engine); the motions Mr. B. Le Van describes are open to the same objections; these can be easily overcome in the former one by making the working edge very slightly curved, and using a piece of very fine clock spring and steel wire for a cord. FRED. W. SALMON.

### Chemistry of Blue-printing.

*Editor American Machinist:*

I wish to say a few words in regard to the article on "Blue-printing," by A. F. Kefflo, in your issue of August 3d.

In the first place, the second sentence in the sixth paragraph ought to read: The free ferricyanhydric acid is precipitated on the addition of chlorhydric or sulphuric acid. With a ferrous solution potassium ferricyanide affords a dark blue. This is Prussian blue, whose symbol is $Fe\ 7\ Cy\ 18$, and the equation ought to be $3\ K\ 6\ Fe\ 2\ Cy\ 12 + 9\ FeSO4 = 2\ Fe7\ Cy18 + 9\ K2\ SO4 + Fe$.

In the same paragraph he says: "This blue is the ferrous salt of hydroferricyanic acid." Prussian blue is insoluble in water, and I don't see how Mr. Robb gets a yellow color to his coating after shaking up the sediment. If this sediment were Prussian blue, I think the coating would have a bluish color.

The second equation is wrong, because he has not put the same number of atoms of each element on each side of the equality sign. This is also the reason the first one is wrong.

The way I understand blue-printing is, that when a paper coated with a mixture of potassium ferricyanide with a ferric is exposed to sunlight, the ferric salt is reduced to a ferrous in the exposed portions, but remains ferric in the places where the sunlight cannot get at it. As soon as the paper is soaked, the ferrous salt and the pot. ferricyanide combine, forming Prussian blue—which is insoluble in water—and the ferric salt is washed out leaving the white paper.

Chemists use pot. ferricyanide and pot. ferrocyanide as a test for iron, as the ferrocyanide will only yield Prussian blue with a ferric salt and the ferricyanide with a ferrous salt.

I am glad Mr. Kefflo gave us his article as I never knew what the real reactions were, and I hope he does not feel badly if I point out a few errors. F. W. S.

### The Strength of Gear Teeth.

*Editor American Machinist:*

If the strength of gear teeth is still open for discussion, I would like to add a few lines in explanation of the position taken in my letter of June 22d, which seems to be misunderstood by "Bell Crank" in his letter of July 27th, and doubtless requires further elucidation.

It is possible I may have done friend "Bell Crank" some injustice in assuming his article of June 8th to have been written in the knowledge of my previous paper on the same subject, but the assumption was natural, and although my criticisms might have been modified by the fact as it now appears, the ground taken would have remained substantially the same.

From the references he has kindly made to suggestions on my part which have led him on, and from his own suggestions of more recent date, we seem to be mutually indebted to each other for our progress in the work of this investigation, and whether we finally agree or not, it is some satisfaction to feel that some good may result from our differences of opinion.

I was not aware that Joshua Rose had used a parabolic curve to determine the

weakest section of a gear tooth, and although my original constructions antedate by several years the publication of "Modern Machine Shop Practice," I cannot deny that the use of a parabola for the purpose mentioned was quite obvious. I find there is a difference, however, in the two constructions which should be noticed. Mr. Rose makes the apex of his parabola tangent to the end of the tooth, while I draw a normal to the face of the tooth at its extremity and start my parabola at the point where that normal intersects the center line of the tooth. My method gives a higher factor of strength, and the reason for my construction is evident from the fact that pressure must be transmitted from tooth to tooth in a line normal or nearly so to the surfaces in contact; the departure from a normal being at the angle of friction and in either direction.

What I meant by saying that the ultimate strength fails to proclaim itself in the formulas proposed by "Bell Crank"—

$$\text{No. 1, H. P.} = \frac{p\ v\ f\ (n-2)\ .33}{s}$$

and

$$\text{No. 2, H. P.} = \frac{p\ v\ f\ (n+340)\ .0205}{s}$$

was, that there was no character in either formula which stood for the ultimate strength of the material in question. The ultimate strength of the tooth can certainly be found by letting $s = 1$, as suggested, but the strength of a tooth and the unit or working stress on its material are two different quantities, and for other materials than cast-iron other formulas are required. My point is that engineering formulas should be written, when possible, for all materials, so that the working stress of any particular material may be introduced as desired. That is, the working stress should proclaim itself in the formula if no doubt is to arise as to the basis of the determination. To illustrate by the formulas just quoted, letting $s = 1$, a certain value will be found for the horse-power of a given tooth, but from the formula used it does not appear what quality of iron that horse-power presupposes. The presupposition was stated by "Bell Crank" in his previous article, but it was not embodied in the formulas as I maintained it should be to insure a correct interpretation at all times. Now we have the formulas apart from their original context and their basis is already out of sight. This criticism applies quite generally to the whole field of engineering literature, and the formulas in question simply serve as convenient illustrations. Many of our standard text-books are careless in this respect, and valuable time is frequently wasted in discovering the meaning of formulas which might have been written quite as easily in terms of the working stress to be supplied by the judgment of the engineer for any particular case.

In reading the chapter referred to in "Modern Machine Shop Practice," I see that values are given for the safe working pressure on teeth at speeds of from 2 feet to 48 feet per second, the variation in extreme cases being about 3 to 1. The old English rule which I used, for want of anything better, gave a variation in extreme cases of nearly 5 to 1, and theoretically I should prefer the table given by Mr. Rose. He does not state, however, how the values given in his table were determined, and, if they have a substantial foundation, it would be interesting to know something about their evolution. It is quite important to arrive at some well-founded conclusion in regard to the effect of speed upon the working strength of gear teeth, and I hope Mr. Rose will be moved to explain.

I am not surprised that "Bell Crank" found the ultimate strength by my formula to be much lower than his, on the supposition that 25,000 pounds could be taken for the ultimate transverse stress in cast iron, and I am glad of the opportunity thus afforded to refer by way of explanation to the valuable paper on "Cast-iron," by Prof. J. B. Johnson, published in the Transactions of the American Society of Civil Engineers, Vol. XXII, February, 1890.

The apparent discrepancy between the tensile and compressive strength of cast-iron, which has puzzled many investigators and given rise to numerous theories more ingenious than convincing, is there clearly set forth, and in the light of the facts shown I feel justified in adhering to the formula $W = \frac{s\ f\ t^2}{6\ l}$ for the working strength of cast-iron, as well as that of other materials. Within the safe working limits usually assigned to cast-iron, the stress-strain diagrams for tension and compression are approximately equal, and, initial or cooling stresses being neglected, the neutral axis of a beam so loaded will traverse the center of gravity of its cross-section. But as the load is increased to the point of rupture, the curves of tension and compression depart more and more from each other, throwing the neutral axis toward the compression side of the beam and adding greatly to its transverse strength. In this way it is clear that when a fair working strength is exceeded, the load carried increases faster than the tensile stress. Some irons will carry more than twice as much as their tensile strength would indicate in the formula quoted. Others will not carry so much as twice, but there is always an excess of transverse strength, and in common practice the ratio may be roughly taken at about 2 to 1. The formula, $W = \frac{s\ f\ t^2}{3.43\ l}$, given by D. K. Clark, may be used to determine the ultimate strength of a cast iron beam, but it cannot be used as a proper measure of working strength, nor can the theory advanced by Mr. Clark that the shearing stresses in a beam add to its moment of resistance be admitted as at all tenable. If 25,000 pounds is the tensile strength of good cast-iron, and a cantilever 1" square and 1" long breaks at 7,500 pounds, it is evident that when so loaded the stress on the tension side is 25,000 pounds, although by the usual formula it would appear to be 45,000 pounds. But if the same cantilever were loaded by a weight of 1,500 pounds, or one-fifth of the breaking load, it cannot be assumed that the tensile stress is only one-fifth of the ultimate, or 5,000 pounds, nor that a factor of safety of 5 has thereby been provided. For such a load the ordinary formula would hold good, and the tensile stress would be more correctly estimated at 9,000 pounds. Thus, for one-fifth of the breaking load the factor of safety is really less than three, and for this reason I maintain that factors of safety are misleading, and insist upon the use of working stress for the determination of working strength.

Another factor, not yet considered, is the influence of initial or cooling stresses upon the transverse strength. That they have a very decided influence is shown conclusively in Professor Johnson's paper, and in cast teeth some advantage might be anticipated on that account, but this is offset by their inferiority of action, and for cut teeth it is difficult to see how any gain could be derived by the stresses set up in cooling.

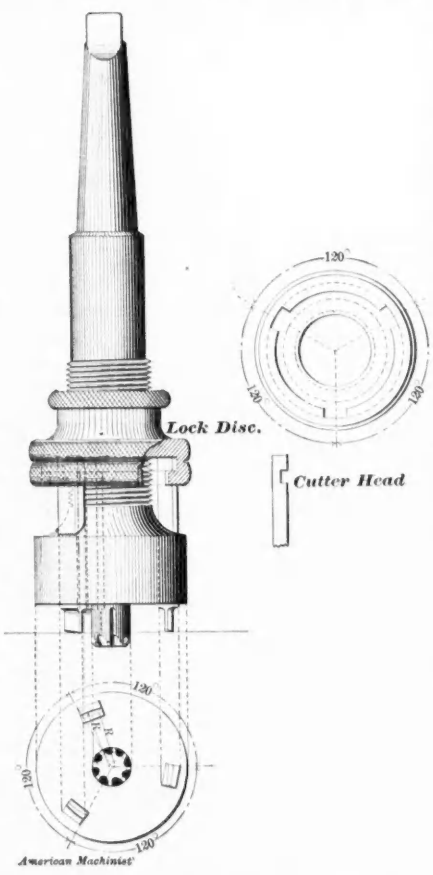
In conclusion, I would like to quote the following "Summary of Errors" from the paper referred to. "The principal fact left out of account in the ordinary formula is the varying stress across the section, even though the section remained plane. When allowance is made for the section distorting, this further increases the variation in the intensity of stress. When we add to these the unknown initial stress of compression in the extreme fibers which must be overcome before any tension is exerted, we probably have quite enough to explain the surprising strength of cast-iron in cross breaking. There is no necessity, in the writer's opinion, for resorting to some occult source of strength arising from the shearing stresses. It is difficult to see how shearing stress can add to the moment of resistance. Shear is not moment, and cannot be converted into moment except by action through an arm. But when the discussion is confined to one cross-section, there is no arm by which the shear may act. It is simply a case of equilibrium of moment of resistance with the moment of the external forces, and the writer believes he is now able to explain the entire moment of resistance, and to prove it by actual test. When computed from the ordinary formula, the stress on the extreme fiber in cast-iron is from one and a quarter to two and a half times what it is by direct tension, and this apparent anomaly has given rise to much literature more curious than useful."

I am not surprised that teeth with small fillets, or none at all, depart somewhat from a general formula covering a 12-tooth pinion and rack, but the departure is not serious, and I think it will be reduced somewhat by my method of construction, in which, by the way, there is no need of drawing the parabolic arc itself. After careful consideration of the subject, I find no reason to change the formulas proposed in my letter of June 22d, and still adhere to the position there assumed. WILFRED LEWIS.

### Flue Hole Cutter.

*Editor American Machinist:*

Probably most of those with experience in cutting flue sheets have had occasion to complain of the lack of proper consideration in the construction of cutters, etc., while this is a question of paramount importance when we consider the welfare of our machine or drill press as to its wearing parts, strains, etc.




The accompanying drawing represents a device I have designed and used that will remove all cause of complaint in this direction.

The drawing shows a "rose-bit" center which could be replaced with a spring center, if desirable, and the spindle of the machine or drill press is strong enough to permit of its use.

There are three cutters or "tools" held firmly in place by the locking device or disk. It is very simple in construction, requiring only a slight turn of the disk to remove the cutters; also when the cutters are replaced they require no adjustment whatever.

The most important features of this cutter are: The small area of the cutting surface, thus reducing the power required to operate it to a minimum; it admits of higher speed than that of the ordinary out-of-date cutters; the cutters are absolutely rigid, thus insuring holes of uniform size, which is almost impossible with the ordinary cutter bar with the cutter keyed; when the hole is cut the cutters are fed down by hand and the "wire edge" formed on the hole is taken off, and the edge rounded a little, thus performing automatically two operations simultaneously in one continuous movement, and consequently effecting a great saving in the cost for labor alone; it performs its work very rapidly; there are no set-screws to give annoyance and trouble; the convenience of having extra cutters on hand. GEO. O. BRADLEY.

Salt Lake City, Utah.

### Ink Lines on Tracings.

*Editor American Machinist:*

Last summer I noticed that several correspondents complained of *flies* eating and blurring ink lines on tracings and drawings. There were several antidotes offered, but as none were as simple or easily attainable as the one I discovered and use, I take the liberty of giving it for the benefit of those who are troubled by the little pests, as they are with us again. It is to simply mix in a little sulphate of quinine in the ink. This I find to be thoroughly efficacious, and it does not injure the ink or instruments.

D. J. JUSTICE.

### Making Manifolds.

*Editor American Machinist:*

In your issue of August 17th, Question 415, G. K., Louisville, Ky., writes of 12-hole cast-iron manifold which they have had considerable trouble with. I wish to state that in 1886 I had the same trouble. The greater part of the trouble lies in the cooling of the casting, it being so uneven in thickness. To separate the flanges will not remove the cause. Put four heads at equal distances along the heavy flange that will hold from three to five pounds of iron each, and when the mold is filled cover the heads with charcoal blacking to keep them from cooling until the flange cools. The four gates in sketch are sufficient, providing they are at the part of mold, but the running gate cannot be the full length of casting, but must be separated in center, and the casting poured from each end.

Greensburg, Pa. J. C. PHILLIPS.

*Editor American Machinist:*

In regard to the trouble with the castings of G. K., Louisville, Ky., August 17, page 9, I think the trouble is undoubtedly caused by shrinkage; the flanges being much heavier than the body of the pipe the gates do not feed them sufficiently.

If he has not already tried it, would recommend casting the flanges down, or they may be cured by heavy risers fed with hot iron if cast up. A proper mixture of iron is also very essential.

Do not think dividing flanges would do any good. E. TROWBRIDGE.

New Haven, Conn.

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One hundred and twenty persons were killed in the city of Chicago last year on the street grade crossings of the railroads. Suppose some company, or institution, were to make application to the municipal authorities of any city for permission to carry on a business, accompanied with the statement that it would involve the killing of a hundred or more human beings, how much consideration or favor would such a proposition secure? Yet in every densely populated city or town in which railroad crossings are maintained on grade with the public streets, this sort of slaughter must be included as a probable accompaniment of the carrying on of the business of the roads. How long will the public tolerate these life-destroying railroad crossings?—Jersey City *Evening Journal.*

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At Ardwell, Wigtonshire, on the farm of Mrs. Ommaney M'Taggart, the whole of the machinery at the homestead for thrashing, sawing, corn crushing, chaff-cutting, etc., is driven by an electric motor. Water-power exerted by a turbine wheel causes the generation of the electricity, the dynamo being about a thousand yards from the farm. The electric current in conveyed by underground wires both to the mansion and to the farm, the former being lit with the electric light, and water is pumped thither for domestic purposes. The farm homestead is likewise lit throughout with electric light, the machinery there being actuated by a 16 horse-power motor.—*The Engineer* (London).

AMERICAN MACHINIST

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☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale.*

☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draftsmen, and all those specially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once. Date on wrapper denotes week with which subscription expires.*

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NEW YORK, AUGUST 31, 1893.

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## Headquarters at the Fair.

During the continuance of the Chicago Exposition the AMERICAN MACHINIST will have its headquarters in the space allotted to the Mechanical Press in Machinery Hall. The exact location is Section No. 27, Column K 37. Word can be left with the attendant there by any one who is desirous of meeting a representative of this paper, who may at the time be engaged elsewhere on the grounds. As the majority of our friends who visit Chicago during the continuance of the Fair will spend a considerable portion of their time in Machinery Hall, we invite them to make use of our facilities there by having their mail addressed in our care as above, where it will be cared for and delivered on demand either by our own representative or by the person who cares for the space in which our desk is located.

## A Comparison of Indicators.

Elsewhere in this issue we publish an interesting communication from Mr. Edward J. Willis on a comparison of indicators. The author, it appears to us, shows that, so far as accuracy is concerned, the three indicators tested stand practically alike. Of course his experiments do not show how nearly absolutely correct the instruments are, but they do show, with fair conclusiveness, that we cannot hope to get absolutely correct results from the use of the indicator, because, apparently, we cannot get the same result twice in succession. For example, in the first set of the table we find the Thompson instrument showing the highest mean effective pressure, although less than two per cent. above the average of the three other instruments. In the second set one of the Crosby instruments shows the highest mean effective pressure, and in the third set the other Crosby instrument shows the highest, as it does in the fourth set. The figures can be used in various ways, but scarcely to the prejudice of either indicator used in the test. Mr. Willis deserves a good deal of credit for what he has done in the matter of comparison of indicators. We shall hope he may do more in the same direction, and in other directions. If we might make a suggestion, it would be that tests at about the speed he has employed to determine the influence of pipes of different lengths and sizes between the cylinder and indicator, also to determine the influence of bends and elbows in the connecting pipe, would be of great interest. We have reason to know that Mr. Willis is fully impressed with the necessity of accuracy in all such tests, and the pains he takes to secure this make his work valuable.

## The Cream of the Exhibition.

There is, it seems, a project on foot to hold an exhibition in New York City during February and March, this exhibition to be made up of those exhibits at Chicago that win prizes, thus securing, as some of the papers put it, "the cream of the Chicago Exhibition."

In the first place, it seems to us that the project of San Francisco people to hold a winter exhibition, arrangements for which are well under way, will interfere with this plan somewhat; and then, too, we very much doubt if it will be strictly true that the prize winners at Chicago will constitute the cream of the exhibition there.

The best feature of the Chicago Exhibition is the exhibition itself, and while other good exhibitions might be constructed out of material taken from Chicago, let no one flatter himself that he will see in New York or elsewhere for many years to come an exhibition as well worth seeing.

In the Transportation, the Mining, the Manufactures and Liberal Arts, Shoe and Leather, and in the Forestry departments especially, the visitor will see exhibits which, for magnitude, comprehensiveness and general excellence will not be equaled until somewhere and at some place another exhibition is organized on an equally magnificent scale, and when or where this will be done, if ever, is for the future to decide.

## Commendable Action.

The action of some of the trades unions of Chicago in taking their funds from safe deposit vaults and placing them in banks is a commendable one, one of the reasons given by the members being that the money if placed in banks will do its proportion in helping to set business moving. One of the unions—the cigar makers'—withdrew and deposited thirty four thousand dollars, and some others nearly as much. Altogether, a very considerable sum was added to the funds of the banks. But of more value than the sum thus made available for business purposes is the effect of the example upon workingmen individually in helping to give them the confidence that will result in a great number of smaller deposits. Speaking of this action of the unions, one of the largest circulated of Chicago dailies says:

In so far as the present unpleasant condition is due to stringency of currency, it can be relieved if all owners of small savings will act on the patriotic example of these trades unions.

More than this, it is to be hoped that the patriotic example of these workingmen will so put to shame some of the capitalists who have hundreds of thousands locked up that they will put their great hoards back in the banks. If it has that effect it will end the panic and restore confidence.

The relations between capital and labor are generally looked upon as always being at high tension in Chicago. Recently the trades unions have proposed concerted action of labor and capital looking toward providing work for the unemployed. Several capitalists who were interviewed on the subject spoke in high terms of the proposition, and at this writing there seems little doubt that there will be united action to that end. This should not only bring about good immediate results, but should as well teach both labor and capital that the other parties were not such terrible fellows after all, which would be an excellent lesson.

We are glad to be able to state that according to those journals in New York which pay special attention to commercial matters and keep posted as to what is going on, the general tone in commercial circles is somewhat improved. This seems to be due mainly to the fact that many people are coming to realize that the present depression is due very largely, though, of course, not entirely, to "scare." In other words while it yet remains true that there is some basis or logical reason for depression, there is absolutely no good reason for a panic, for the wholesale withdrawal of bank accounts and locking up of funds. It is one of the curious manifestations of human nature that a crowd composed of sentient and reasonable individuals can in time of panic become so utterly insane and so absolutely unreasonable.

Recent bank statements are regarded as much more favorable, and we hope the worst of the present flurry is past.

In reducing the rate of production, as is made necessary in many cases by the present unfavorable condition of business, two different methods are employed—one is to reduce the number of employes, the other to reduce the working time; and a manufacturer who must curtail production should consider which of the two methods is best. In these times the man who has been taking little interest in his work beyond six o'clock and pay day, who has been so managing things as to "just hold his job," must expect to be the first one "released," it being not only natural, but also proper, for an employer to retain his most valuable men and let the others go.

But after the least desirable men have been weeded out, and those that remain are worth retaining, if possible, until such time as business improves, then it seems to us that a reduction of working time is much to be preferred, rather than to scatter and perhaps irretrievably lose a corps of good men. The fixed charges will usually remain about the same; the most desirable men are retained; it is fairer to the men to thus have them share equally what work there is to do, and the general effect upon business is undoubtedly much better.

An absolute shut-down for one or two days per week effects the same reduction of production and of the pay-roll as the discharge of one-sixth or one-third the force of men, and it has the advantage of entirely stopping expense for power and some other items which must go on about the same every day the shop runs, no matter how small the force may be.

## Irrigation Congress.

A call has been issued for an Irrigation Congress, to be held at Los Angeles, California, during the week beginning October 10. At this congress it is proposed to consider questions pertaining to irrigation, including its economic, political and engineering features.

## Literary Notes.

The September number of *Scribner's Magazine* has for one of its leading features an article on "The Machinist," which was written by Mr. Fred. J. Miller, one of the editors of this paper.

The article is, of course, intended for popular reading, and to give the general public some idea of what the machinist and his vocation are like. Our readers, most of whom are machinists, will be, of course, interested in the article, and in the fact that they are there presented to the public in a very favorable light. The article shows that the author is thoroughly familiar with his subject and convinced that the machinist and his work constitute a very important factor in our civilization and its development.

The illustrations accompanying the article are, as usual, very fine. They are by O. H. Bacher and are taken mostly from life and from scenes in well-known machine shops.

A HAND-BOOK OF VARIOUS PUBLICATIONS, DOCUMENTS, AND CHARTS CONNECTED WITH THE RISE AND DEVELOPMENT OF THE RAILWAY SYSTEM, CHIEFLY IN GREAT BRITAIN AND IRELAND. With prices at which they are now to be sold; by Edward Baker, 14 and 16 John Bright street, Birmingham. Compiled by S. Cotterell. Price one shilling.

This hand-book is primarily a catalogue of antiquated books relating to the development of the railroad system in Great Britain and Ireland. But it differs from the ordinary catalogues in the fact that the titles of books are arranged in a chronological order, and with each is given a short outline of the subjects of which the book treats, thereby indicating, to a small extent, at least, the gradual development of the railway system. This increases the value of the catalogue, attracts the attention of the reader, and makes it well worth preserving.

THE PROGRESS OF MARINE ENGINEERING FROM THE TIME OF WATT UNTIL THE PRESENT DAY. With sixty-seven illustrations. By T. Main, M. E.

In this work of 248 pages is given a concise historical sketch of the marine engine and its growth to its present state. The author who is a marine engineer of wide practical experience is thoroughly conversant with the subject he treats on and has succeeded in stating it in an exceedingly interesting manner. The illustrations are good, and the whole forms a very creditable work. Any one who wishes to become familiar with the gradual development of the marine engine in a general way and obtain a reliable account of what has been done, and of what is being done at the present day to secure a greater economy of fuel, increase of speed, and safety in ocean travel, both in the naval and mercantile marine service, cannot do better than to procure a copy of this work. It is published by the Trade Publishing Company, 56 Vesey street, New York. The books are sold by the author, Thomas Main, 1304 Garden street, Hoboken, N. J. Price $3.

# QUESTIONS AND ANSWERS.

*Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.*

(431) A. W. S., Skönvik, Sweden, writes: Please give method of designing bells, rules for computing thickness of metal, and for determining other proportions. *A.*—The construction of bells, rules, etc., will be found in our issue of November 13, 1891.

(432) R. H., Buffalo, N. Y., asks: What will be the efficiency of a water wheel drawing 526 pounds of water in one minute, with 193 feet fall; the wheel is 39 inches in circumference, running at the rate of 2,000 revolutions per minute, and pulling 11 pounds at the circumference of the wheel? *A.*—70 per cent.

(433) J. P., Moline, Ill., asks: How many tons of iron can be drawn from a cupola 4 feet 6 inches diameter at one run, that is, without cleaning until it cannot be recharged? *A.*—You will find this information in our issues of June 30 and July 14, 1892. 2. What is the greatest amount that has ever been taken from a cupola under the above conditions in this or any other country? *A.*—We do not know; in fact, we believe that it is impossible to answer this question.

(434) W. L. B., Richmond, Va., asks: What course should a young man pursue to obtain a license for running a marine engine? I have served an apprenticeship in a locomotive repair shop. *A.*—We should advise you to go to work in a shop where marine engines are built or repaired, so as to become thoroughly familiar with the parts of marine engines and boilers, and study during your leisure hours books and literature treating on the marine engine. For further information, see answer to Question 411 in our issue of August 17, current volume.

(435) C. A. C., Kokomo, Ind., has sent us drawings and a description of what he calls a boiler cleaner. It consists of an internal pipe perforated on its under side; this pipe is connected to the blow-off valve at one end of the boiler, and extends to the opposite end of the shell, where the end of the pipe is closed; the distance between the pipe and plates is about 1½ inches. Our correspondent asks: Has this invention any practical value, and can it be patented? *A.*—Experience has shown that this kind of a bottom blow-out apparatus, when kept in good working, and used twice or thrice a day, is of marked value where the impurities are heavy and sink to the bottom of the boiler. Since this is not a new invention, you cannot have it patented.

(436) R. K., Columbia, S. C., writes: We have some solid cast iron rolls to make, with steel shafts 3 inches in diameter; the rolls are 9 inches in diameter, and 15 inches long. Our efforts have not been satisfactory. Please suggest a method for casting these rolls with the shaft remaining tight in the casting. *A.*—Probably the best method is to turn the shaft, giving it a smooth surface, and then tin it. Others claim that heating the shaft to a dull red heat just before the metal is poured gives satisfactory results. Sometimes a coarse thread is cut in the center of the shaft, for which also good results are claimed. This subject has been fully discussed by practical men in our issues of May 9, 23, 30; June 6, 20, 27; July 4, 11, and August 1, 1885. We would advise you to read these articles.

(437) D. C., Columbus, Ohio, writes: Please inform me of a process for covering cast-iron with a coating of copper, and give exact proportions of materials used. *A.*—One way to deposit copper upon cast iron is as follows: The pieces of cast-iron are first placed in a bath made of 50 parts hydrochloric acid, specific gravity 1.105, and 1 part nitric acid; next, in a second bath, composed of 10 parts nitric acid, 10 parts of chloride of copper, dissolved in 80 parts of the same hydrochloric acid as just alluded to. The objects are rubbed with a woolen rag and a soft brush, next washed in water, and again immersed until the desired thickness of copper is deposited. When it is desired to give the appearance of bronze, the copper surface is rubbed with a mixture of 4 parts sal-ammoniac, and 1 part each oxalic and acetic acids dissolved in 30 parts water.

(438) W. B., Mansfield, O., writes: Kindly give me your advice in regard to learning the machinist's trade. I am at present in a dry goods store but it does not agree with me. I would like to know whether I had better work in a shop and study at home or go to some scientific school. If the former, what books should I study? And if the latter, which school should I enter? *A.*—We should advise you to go to work in a machine shop and study during your leisure hours. The course of home study, with the books required, is given in our issue of February 19, 1891. After you have served your apprenticeship it will be advantageous to you to go through a course of study in a technical institution of which there are several in your State; join any of them, you will learn as much in one as in another provided you are determined to learn. If you earnestly pursue the course of home study indicated above, it will assist you in passing an examination for the admission into a technical school.

(439) S., Akron, Ohio, writes: Please give the mixture for semi-steel rolls. *A.*—It is almost impossible to give a mixture which will be satisfactory under all circumstances; indeed, even if one could be given, it requires considerable experience to select the right grade of iron. The diameter of the rolls will also influence the mixture. Another difficulty in giving correct information on this subject is that the correct mixture is obtained only by a great amount of labor and study, and those who are engaged in this business do not care to give the results of their labors away. In our issue of July 10, 1886, a table of various mixtures for iron rolls is given by an experienced molder, and we believe this table to be reliable. The manner in which this subject has been treated by the author will also indicate the difficulties to be encountered, and the experience required in making the proper selection of the materials. 2. What is spiegeleisen worth per pound? *A.*—For this information write to any dealer in iron.

(440) B. L., Wilmington, Del., writes: I have a line shaft running at the rate of 135 revolutions per minute. It is driven by a slide valve engine, 16x20 inches, with a pulley 84 inches in diameter on the crank-shaft; the pulley on the line shaft is 60 inches diameter; these, of course, give an engine speed of 96 revolutions per minute. Now we have a Corliss engine, 14x36 inches, with a pulley 72 inches diameter on the crank-shaft, and a 48-inch pulley for the line shaft; these will give an engine speed of 90 revolutions per minute, with the line shaft running at the rate of 135 revolutions per minute as before. The Corliss engine is to take the place of the slide valve engine. We carry 60 pounds boiler pressure. What I would like to know is how many horse-power will I gain by using the Corliss engine? Ordinary rules show a gain of about 30 horse-power, but it seems to me that this is too much. *A.*—Under the above conditions, the slide valve engine, with a mean effective pressure of 30 pounds, will develop about 58½ horse-power; the Corliss engine will develop, with the same mean effective pressure, about 75½ horse-power, showing an increase of 17 horse-power. 2. Will I lose any power on account of the reduced diameter of the pulley on the Corliss engine? *A.*—No.

(441) C. E. K., Cortland, N. Y., writes: Kindly advise me as to my difficulty of making blue prints. My solution is 1¼ ounces of red prussiate of potash in 8 ounces of soft water, and 2½ ounces of citrate of iron and ammonia in 8 ounces of water dissolved separately and then mixed. I apply the solution with a sponge first in one direction and then at right angles to it; when dry I place it in a photographer's printing frame, and expose it from five minutes to three hours. When I am washing the print the solution washes all off without leaving any trace to speak of. I have tried three samples of paper without any difference. I made a new solution, thinking that the chemicals were poor. The paper will not even turn blue when exposed by itself, and I cannot make it blue in any way. The paper has a light yellow color after it is prepared. *A.*—Although you use proportionately a greater amount of citrate of iron and ammonia than we have been accustomed in using, we do not believe that your difficulty is due to this. In our opinion you have not the right chemicals; get these from another druggist and follow the directions given in answer to Question 375 in our issue of July 27, current volume; we have had no failure with this process. 2. I have a rule for making prints with black lines on white ground. After the paper has been exposed the rule says, "apply developer immediately with a sponge or soft copying brush over the entire surface of the print." The part I do not understand is the developer. What is it composed of? *A.*—There are several processes for making prints of this kind and each has a developer of its own, and since you do not indicate which process you follow it is impossible to answer your question correctly. Even had we known the process it is doubtful whether we could give a correct answer, as the inventors of these processes do not care to divulge the chemicals used in the developers.

(442) X. Y., ——, writes: In computing the magnitude of a force to produce a certain effect, and in many other engineering formulas, the weight of the body is divided by the acceleration produced by gravity. Please give the reason for doing so. *A.*—Since nothing is known of what force is, the magnitudes of forces can be determined only by their effects. The force with which others are compared is the force of gravity. Weight is the measure of the attractive force of gravity. When it is said that a body weighs one pound it is understood that the attraction of the earth on this pound of matter is a force of one pound. It is found by experiment that if a body be allowed to fall freely from rest for one second it will have at the end of that time a velocity of 32⅙ feet per second; for many practical purposes 32.2 feet, instead of 32⅙ feet, is used. This velocity is called the acceleration which is usually denoted by the symbol $g$; and the force which produces this acceleration is equal to the weight of the body. Forces acting on a body are proportional to the accelerations which they can produce. Hence if a force $f$ acting as a constant pull or push on a body perfectly free to move in the direction of action of the force produces an acceleration $a$, and gravity acting on the same body with a constant force $W$, equal to the weight of the body, produces an acceleration $g$, we have the simple proportion,

$$f : W :: a : g \qquad (1.)$$

from which we get,

$$f \times g = W \times a \qquad (2.)$$

hence,

$$f = \frac{W}{g} \times a \qquad (3.)$$

This shows the reason for dividing the weight of the body by the acceleration due to gravity. Now in regard to other engineering formulas let us go one step further. Formula (3) is not given in its simplest form. The quotient obtained by dividing the weight $W$ by the acceleration $g$ is called the *mass* of the body; or denoting the mass by $m$, we have $m = \frac{W}{g}$. Hence formula (3) may be written,

$$f = m \times a \qquad (4.)$$

From this we obtain another very important formula in engineering. It can be shown that $a = \frac{v}{t}$, in which $t$ denotes the time in seconds during which the constant force acts, and $v$ the velocity in feet per seconds at the end of that time. Substituting in formula (4) for $a$ the value $\frac{v}{t}$ we have,

$$f = m \times \frac{v}{t}$$

from which we obtain

$$f \times t = m \times v \qquad (5.)$$

in which the quantity $f\,t$ is called the impulse, and the quantity $m\,v$ is called the momentum of the body whose mass is $m$. It will be instructive to show an application of the last formula. Suppose a body weighing 50 pounds is drawn along a horizontal plane by a constant pull of 12 pounds, the coefficient of friction being $\frac{1}{10}$, what will be the velocity at the end of six seconds? The mass of the body is equal to $\frac{50}{32.2} = 1.55$. The frictional resistance will be $\frac{1}{10}$ of 50 pounds = 5 pounds; hence the effective pulling force will be $F = 12 - 5 = 7$ pounds. From equation (5) we have $v = \frac{f \times t}{m}$, substituting for the symbols their values, we have $v = \frac{7 \times 6}{1.55} = 27.09$ feet per second. Take another example: What will be the constant force acting during five seconds to impart to a body weighing 150 pounds a velocity of 15 feet per second? The mass is equal to $\frac{150}{32.2} = 4.658$. From equation (5) we have $f = \frac{m \times v}{t}$, substituting for the symbols their values, we obtain $f = \frac{4.658 \times 15}{5} = 13.974$ pounds. From formula (4) we can obtain another, and one of the most important formulas in engineering practice. It can be shown that $v^2 = 2\,a\,s$, in which $v$ and $a$ denote the same quantities as before, and $s$ the space or distance in feet through which the body moves. This gives us $a = \frac{v^2}{2 \times s}$. Substituting this value of $a$ in formula (4) we have,

$$f = m \times \frac{v^2}{2 \times s},$$

which reduces to

$$f \times s = \tfrac{1}{2} \times m \times v^2 \qquad (6.)$$

The expression $\frac{1}{2}\,m\,v^2$ is called the kinetic energy; some authors call it the *vis viva*, or living force of the body; and the expression $f\,s$ is the work which the kinetic energy is capable of performing. Remembering that $m = \frac{W}{g}$, formula (6) may be stated as follows:

$$f \times s = \tfrac{1}{2} \times \frac{W}{g} \times v^2.$$

It will be seen that all the foregoing formulas have been mainly derived from the simple statement of proportion (1), and which plainly shows the reason for dividing the weight of the body by the acceleration $g$.


# BUSINESS SPECIALS

*Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.*

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## A Symposium With the Aviators.

BY WILLIAM H. HARRISON.

Some time ago one of your correspondents, criticising my letter on Maxim's flying machine, accused me of being "unfriendly to students of aviation." That such is not the case, the following account of a symposium of aviators—in which I had the pleasure of assisting—will show:

An acquaintance of mine who lives in a mortgaged house, but always has a little money to drop in each new fake which comes under his notice, invited me to go with him to State street in Boston, and see a "new thing which was being quietly developed, which was to do away with all the present systems of railroads and shipping; all they want is a little more money, and they are getting it very fast, so you will have to hurry up if you want a chance to invest in the greatest discovery of the age, etc., etc."

I afterwards learned that this man, who to me appeared honest, was getting 30 per cent. commission upon any new subscriptions for the stock which he might bring in.

This commission was faithfully paid him, in sheets of engraved paper torn out of the

stock-book by the chief aviator, and my honest acquaintance was happy in the receipt of a good income in stock. A good fat stock-book in the hands of an experienced promoter of fakes, is for the time quite as good as a fat bank account. He can negotiate for any sort of property, which has any real value, and be sure that he is not going to be cheated. He can pay a board bill, or room rent, and get some cash balance, to pay car fares, and drinks withal.

He can get booming editorials in the daily papers—advertisements and commendatory reports of college professors must usually be paid for with money.

He can get leading politicians to have their names spread abroad, as presidents and directors, so as to get a pull upon their followers. Quite recently a member of the U. S. Senate, from one of our mountain States, exhibited a cut of his Solonic head at the top of a quack medicine "recommend," written by himself, "for the benefit of suffering humanity."

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Having seen a good many of "the greatest discoveries, etc., etc.," I did not enthuse much over the matter until the idea came in my mind of the fun which there might be in attending, with the recommendation of being a countryman with money; so up I went to a room in the 12th story of one of our big new office buildings—which big buildings are perfect swarming places for fake operators—and was introduced to a man in long hair and spectacles, who was the great inventor and chief aviator.

There was also another man who gave me an unpleasant turn when I looked upon him; he was of great height and size of bone, and equipped with but one eye—not exactly in the middle of his forehead, like the "ogre" in "Sinbad the Sailor"—but which, with its size and inflamed condition, and redness of his hair, gave me the impression of great heat and ferocity. This was the assistant aviator, and, in spite of his appearance, he had been thoroughly tamed by his chief selling him stock for a hundred or two dollars, then giving him a mortgage upon the furniture in the room—which mortgage afterwards proved to be second or third—for more money, and he had become fearful that he was not to see it again.

Several other persons, stockholders, actual and prospective, were present, and being called to order by the chief, were addressed as follows:

"GENTLEMEN—I have called you here together for the purpose of exhibiting a demonstration of the great discovery which I have made, by means of which we will be able in a short time to pass with almost lightning speed from point to point, doing away with railroads and steamships, and enabling us to carry the heaviest freights with the utmost economy.

"While other inventors have been worrying over the problem of how to make a flying machine light enough to be held aloft by its own power developed in constantly working engines of delicate and unreliable construction, I have gone on and discovered and developed the *true principle*, by the use of which I am not limited to skeleton constructions of aluminum, bamboo, and oiled silk, and on which no man would ride more than once, as he has not the brains of a goose to guide his cumbrous trap. This true principle is the *air ship*, which may be built of steel and heavily loaded and *floated in the air*, with the same or greater safety than an ordinary ship upon the water.

"As regards ships upon the water, any naval architect will tell you that each cubic foot of the displacement of the ship will carry only 64 pounds of weight.

"In my *air ship*, which is floated by forming a vacuum under the deck by the method which I have named *anthexis*, I can do immensely better. Thus scientific men are agreed that the atmospheric pressure which raises the water in a common pump is about 14.7 pounds per square inch, or upwards of 2,000 pounds per square foot. If the weight to be carried is less than the 2,000 pounds, all I have to do is not to exhaust my air so perfectly.

"Take an actual steamship, 318 feet long, 40 feet wide, drawing 18½ feet of water. The displacement, which is the actual weight of the entire ship and cargo, is 3,440 tons, of 2,240 pounds each, which gives 8,400,000 pounds.

"The area of the deck of this ship is about 7,600 square feet, so that floating this ship in the air by the principle of *anthexis*, I have only 1,105 pounds to be supported by each square foot, or less than 8 pounds per square inch, a vacuum or reduction of atmospheric pressure which it is perfectly easy to attain.

"I challenge any experts you may bring to disprove the correctness of my figures.

"Once the ship is properly floated in the air, the propulsion and steering becomes a very simple matter, on account of her great strength and compactness; the resistance of the air even when blowing a gale is easy to overcome by suitable propellers."

All this and very much more by way of introduction.

"Now, gentlemen, that you may see and judge for yourselves whether I have been making empty brags or not, I have prepared this practical demonstration." Here he pulled a cord, causing a drapery or petticoat to slide up on a tight wire depending from the ceiling at the far end of the room. The lower end of this wire was attached to the diaphragm or bag end, of what 40 years ago was described in the philosophy books, under the head of Pneumatics, as the "Weight Lifter."

The weight lifter as used in the schools was a bowl of heavy glass about 8" diameter, with a bag of rubber cloth, of the same size and shape, secured air tight to the rim; the bowl was inverted upon a high stool, having a ring for a seat; weights were attached to the bag, and the air exhausted by an air pump connected by a hose to the center of the bowl, and the atmospheric pressure forced the bag up into the bowl, and lifted the weights.

This astute aviator, no doubt observing that the use of the stool would suggest a terrestrial rather than an aerial support for his ship, threw out that part of it, and as he wished to show the action of vacuum upon the upper surface only, turned the flexible part up, and attached the wire to that, forming the real support for the apparatus. The hose for exhaustion passed through a door into another room.

But let him proceed.

"I have, at great expense, caused this to be made in glass, so that you may be able to see from the internal operation that there is no deception. Here on the floor is 100 pounds of sash weights attached to the model. The model being of glass, this cord (hose) prevents it from drifting about the room and getting broken when it floats; for the same reason it is supported by this wire *when not in use*.

"I have discovered that this *anthexical* action is so sensitive in this small model that by merely tapping once upon the glass you will see it rise, taking its weight from the floor."

He tapped, and, behold, it was so.

"I tap twice, and it ceases to rise. Three times, and it lowers itself and its weight. Twice again, and it stops lowering.

"I am not able to tell at present whether this is a vibratory or a hypnotic action upon the molecules of the ether remaining in the glass after the exhaustion; there is high scientific authority for either hypothesis," etc., etc.

"I will now replace the covering, as I do not wish to have the principle of operation made known until the company is ready to protect itself by broad patents.

"There is yet a little stock left; some large blocks have been set aside for Mr. A., Mr. B. and Mr. C." (naming some of our best advertised capitalists), "who are never known to take hold of anything unless it is good" (they have taken many good things, the insolvency law being the last), etc., etc.

While he was speaking, my friend the ogre came into the room from outside, looking, if possible, more heated than when he disappeared, unnoticed by most of the audience, and a suspicion came into my

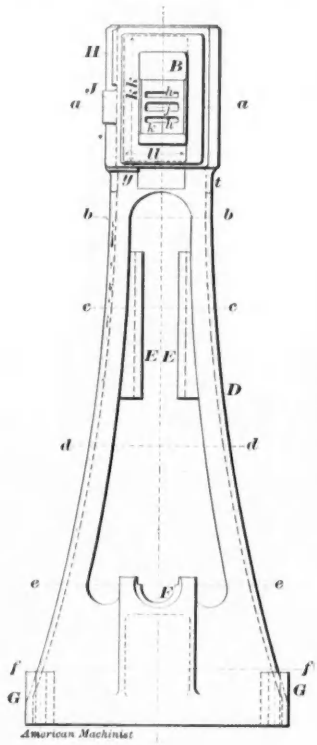

Fig. 1

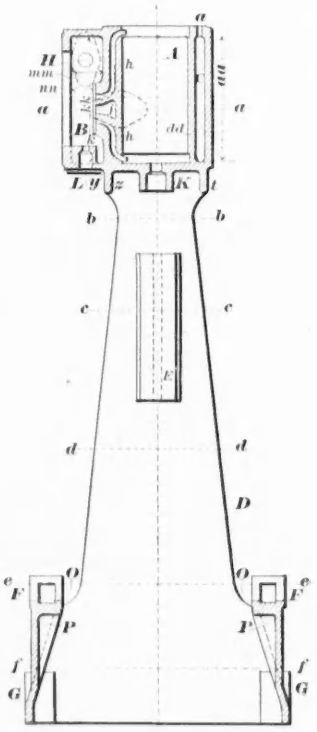
Fig. 2

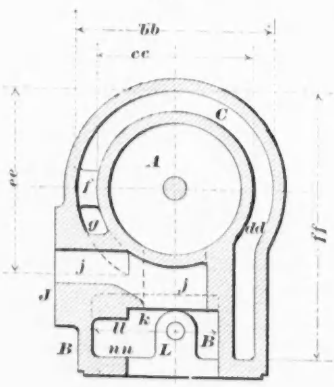
Fig. 3
Section a–a

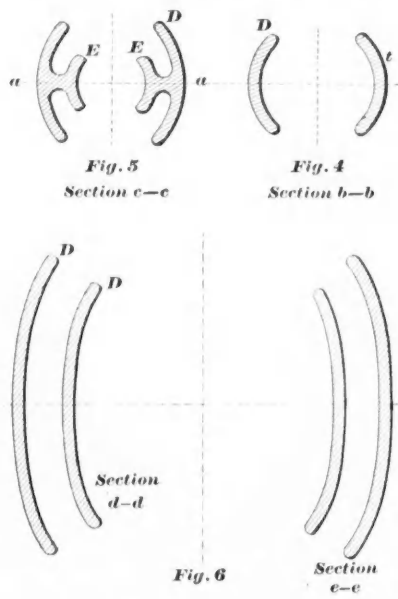
Fig. 5
Section c–c


Fig. 4
Section b–b


Fig. 6
Section d–d
Section e–e

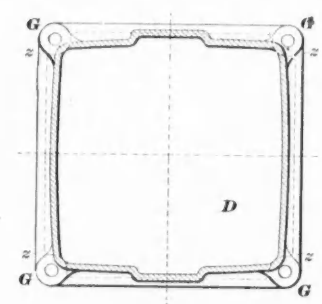
Fig. 7

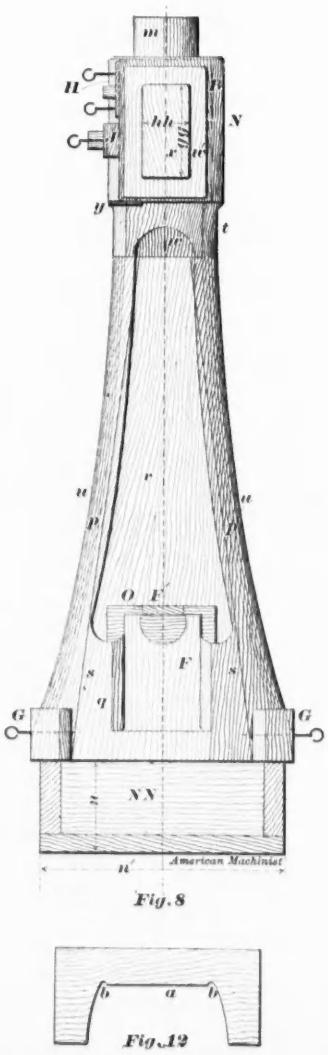

Fig. 8


Fig. 12

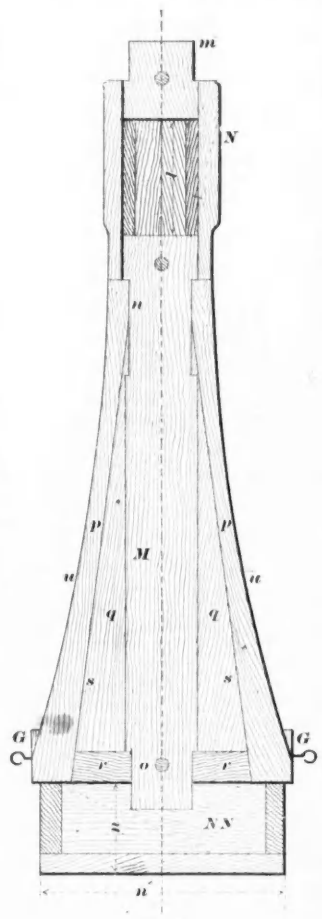
Fig. 9

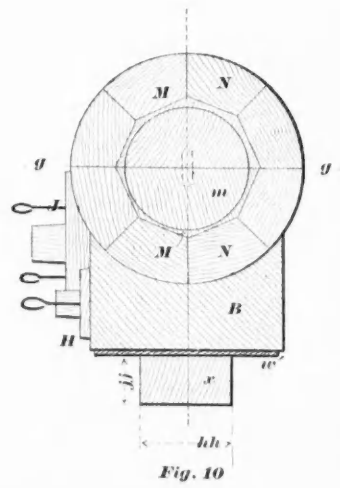
Fig. 10

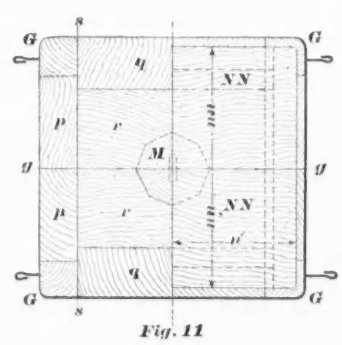
Fig. 11

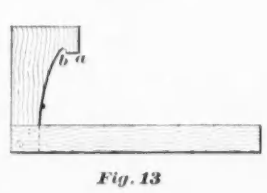
Fig. 13

ENGINE STANDARD AND CYLINDER PATTERN.

mind that here was the *deus ex machina*, the worker of the air pump in the next room, and that his name was *Anthexis*.

## An Engine Standard and Cylinder Pattern—I.

BY J. H.

Figs. 1–7 (page 10) illustrate the main casting for one of the small stationary engines which occur in so many modified types at the present day. It comprises, in one casting, the cylinder, standard and crank bearings. It is bolted to a base, which fulfills the purpose of a tank, and which likewise carries the boiler, and the whole is portable on road wheels. The casting shown here is selected for illustration because it involves a very considerable amount of neat and careful pattern work, as well as rather troublesome molding, the cores being numerous. Although modified methods of construction would be practicable, I will describe this just as it was actually made and molded.

In the figures, *A* is the cylinder bore, *B* the steam chest, *C* a steam jacket cast with the cylinder, *D* the columnar standard, cross sections of which are shown in Figs. 4–7, *E E* the guides for the cross-head, *F* the crank shaft bearings, *G* the hold down lugs, *H* the steam flange, *J* exhaust ditto, *K* cylinder stuffing box, *L* steam chest ditto, *h h* steam passages, *j* exhaust ditto, *k* valve face. Minor letterings will also be referred to when describing the pattern work.

Notwithstanding that cylinders are mostly cast upon end, as the best method of insuring sound metal, such a course in this case where the standard is cast with the cylinder would entail several difficulties in the venting and securing the cores. For this reason the pattern is molded upon its side, and the mold poured similarly.

Figs. 8–11 illustrate the pattern in various aspects. It is jointed along the plane *g g*, Figs. 10 and 11, which allow of the steam chest core being placed lowermost in the mold instead of sideways, and it brings the crank bearings at bottom and top of the mold instead of sideways. Fig. 8 is an external view of the pattern; Fig. 9 shows one half open in the joint face.

As it would be very injudicious to make such a pattern as this in solid wood, it is lagged up in the manner shown in the figures. First there is a central body or blocking *M*, upon which the body of cylinder and base alike are built. This is of hexagonal form, and runs nearly the whole length of the pattern. This is shown at *M* in the end views, Figs. 10 and 11, and in the plan of the joint face of the pattern in Fig. 9. The only reason for having a space at *l* destitute of the blocking was because there would be less risk of the cylinder body becoming affected by extremes of temperature than there would have been if that portion were blocked quite solid. The long portion of the stem below and the short portion above are first doweled together in the rough, and planed to the hexagonal section. The half containing the dowel holes is then laid upon a joint board or upon a true bench at the proper distance *l* apart, and the cylinder body *N* lagged up upon it, all joints both faces and edges being well glued, and the lagging strips being screwed besides to the blocking. Then at this stage the work is put into the lathe and the cylinder body *N* turned, and and also the print *m* for which the stem *M* is extended about 5 inches beyond the cylinder end. Also a portion is turned at *n* and a similar portion at *o*, Fig. 9, to receive these portions of the pattern base which have to be fitted to them subsequently, as seen in Fig. 9.

On each half of the pattern there are three main pieces of stuff which form the base. These are seen in the end view, Fig. 11, *p p* and *q q*, and also in Figs. 8 and 9. Each of these may be formed in one, or in two pieces jointed. I show them each in one piece; this is merely a matter of detail which depends on what stuff happens to be available in the shop. These pieces are fitted at the small end round the turned portion *n* of the central stem *M*, and at the large end to the cross pieces *r r* which are fitted around the central stem. The pieces *p p* are also jointed longitudinally in the joint face *g g* of the pattern, and also along the planes *S S*, Figs. 8, 9 and 11 and they are also glued to each other along these latter planes.

In Fig. 9 it will be noted how the cylinder lagging comes well over the long central stem *M*, and how the butting of the longitudinal pieces *p p* and *q q* coming up to the lagging on the same stem renders the pattern practically solid, while retaining at the same time all the advantages of building up, namely, freedom from liability to warp and shrink, and lightness.

At this stage of preparation the pattern is, except for the turned cylinder, a roughly rectangular lump bearing little relation to the rounded and curved outline which it is required to possess; and a good deal of detailed cutting has to be done now with chisel and gauge, and planes, to templets. First the bottom end, Fig. 11, is marked round to the outer lines shown in Fig. 11. This end has to merge into the circular form at *t*, turned in the lathe; compare Figs. 1, 4 and 8. Between these two extremes the sections vary in every transverse plane, as seen in Figs. 5–7. Certain sections are taken, corresponding with sections taken from the full sized shop drawing; *b*, *c*, *d*, *e*, *f*, Figs. 1–7; and the widths at these sections are taken and marked off in the joint face of the pattern, Fig. 9, and the curves *u u* are drawn through them from end to end with a strip of wood bent to the curve which passes regularly through these points, a nail being driven in at each point to hold the strip against, while the curve is being marked. These curved edges are set in with the gauge and chisel and the curves marked thence on the joint face of the other half of the pattern.

Next templets are made to the transverse half section of the pattern at the several points already taken, and by means of these the pattern is cut to shape at those precise sections. Fig. 12 shows a templet for the section at *d d*. Or a half templet, Fig. 13, set from the joint face is used. Four or five of such sections will be taken, and four or five separate templets made. And afterward the portions intermediate therewith are worked lengthwise from section to section. In this way accurate results are secured. Of course, the curvatures of the templets for the sides *u u* of the pattern vary as the section changes from the almost rectangular form of the base to the circular form next the cylinder. The reason of the section of the templets at Figs. 12 and 13, *a b* will be evident on a comparison with the sectional form of the casting, shown in Figs. 5 and 6. The whole of the interior is cored out, but no print is used to carry the main core beyond the end print *m* in Figs. 8 and 10. Elsewhere the main core only lies upon the flat surface of the mould, formed by the pattern at *V*, Fig. 8, and this is the portion which is worked by that part of the templet marked *a*. And the reason why the face is shouldered down with a convex edge is because the casting has a convex edge in section; compare Figs. 4 and 6, and this is formed in the pattern entirely. Hence the reason for the concave edges *b b* in the templets, Figs. 12 and 13, which impart the convex edges to the pattern.

A portion of print is formed at *w*, Fig. 8, of circular form. This receives the circular portion of the core which encircles the stuffing box *K*, seen in Fig. 2.

Upon the body of the pattern, thus prepared and brought into outline, several parts have now to be fitted. Beginning at the cylinder end there is the block *B*, Figs. 8 and 10, which forms the steam chest, corresponding in outside dimensions with the steam chest *B* in Figs. 1 and 3. This is screwed to the cylinder body. Upon it is screwed the facing and the print, corresponding in length *g g* and in width *h h* with the length and width of the steam chest opening in Figs. 1–3. The facings *H* and *J*, for steam and exhaust, respectively, with their prints are skewered upon the steam chest, Figs. 8 and 10. A facing *y* for the valve rod guide (compare with Figs. 1 and 2), completes the cylinder end of the pattern.

At the lower end there is the print *N N* which supports at that end the main body core. This is made of good width *n*, lest the core, being heavy, should crush the sand. It is always better for this reason to give ample bearing to prints, even though in excess, to prevent the risk of heavy cores crushing. This print is boxed up, as seen in the views, its length is *n'*, and the depth of each half is *n n*.

Then there are hold-down lugs *G*, Figs. 8, 9 and 11. These are fitted into angular recesses cut in the pattern, seen clearly in Fig. 11, and are skewered on, so that they shall deliver after the main pattern, the reason of this being their under cutting at *Z*, as seen at Fig. 7. Their bolt holes are not cored, but drilled. The crank bearings *F*, Figs. 1 and 2, are fitted as shown at *F*, Fig. 8.

The main outlines of the bearings *F F*, in Figs. 1 and 2, are the same in casting and pattern, but the seating for the brasses is cored out with the print *F'*, Fig. 8, and the space *O*, in Fig. 2, is also necessarily cored out with the print *O* in Fig. 8.

This, except for cleaning up and varnishing, completes the pattern. There is, however, nearly an equal amount of work involved in the construction of the core boxes, but I must defer the consideration of these to another paper.

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It is announced by the Secretary of the A. S. M. E. that about forty members of the French engineering societies who arrived in New York by the steamer "La Champagne" August 26, will remain in New York one week as guests of the N. Y. Welcome Committee acting especially for those American engineers who went to Paris in '89, and will then proceed to Chicago *via* Niagara Falls. Returning the party will go *via* St. Louis, Pittsburgh, Washington and Philadelphia, leaving New York for home by steamer "Havre" September 30.

## "Men Wanted."

The President of the U. S. Civil Service Commission informs us that there is a demand for more fourth assistant examiners in the Patent Office than the Commission is able to supply. It, therefore, wishes to make known to as many students of colleges and other competent persons as possible, that such positions are open. The salary is $1,200 per annum, and a pamphlet containing full information will be sent to those who desire to become applicants. In addition to the regular dates and places of examinations as given in the schedule, the Commission will arrange to give the examination on September 7 in Boston, New York, Philadelphia, Detroit, Chicago, St. Louis and Omaha, if there are applicants for these places.

Requests for application blanks and for the pamphlet of instructions should be addressed to the United States Civil Service Commission, Washington, D. C.

## MANUFACTURES.

Many improvements and repairs are being made about the Crown Manufacturing Company's plant at Phelps, N. Y.

Ground has been broken for the new N. R. Pegg tool manufactory at Utica, N. Y. The building will be 204x50 feet.

Hayden & Dunbar have commenced the rebuilding of their recently burned foundry and machine shop at Carleton, N. B.

The Morris Bailey Cold Rolled Steel Company will soon move its works to Wilson station, near Monongahela City, Pa.

The Baldwin Locomotive Company, of Philadelphia, will build 18 six-wheel locomotives for the Erie Railroad Company.

The Galveston & Western Railroad Company will erect a railway bridge across the Galveston Bay, near Galveston, Tex.

The Michigan Peninsula Car Manufacturing Co., at Detroit, Mich., is looking for a good site to which to remove its plant.

Two hundred men are engaged in constructing the Lenoir (N. C.) Car Works, and the buildings are nearly ready for machinery.

The Bourke Manufacturing Company, of Youngstown, Pa., will soon enlarge the plant and conduct business on a much larger scale.

Work has been commenced on the buildings for the Georgia, Carolina & Northern Railroad repair shops, etc., at Abbeysville, S. C.

The Franklin Iron Company, of Franklin, Mass., will remove its foundry to Milfred, where large and suitable buildings will be erected.

The Chattanooga Company, of Chattanooga, Tenn., is preparing specifications for the proposed steel bridge over the Tennessee River.

The Record Foundry and Machine Company has commenced the enlargement of the molding department at its plant at Moncton, N. B.

The Arctic Machine and Manufacturing Company, of Cleveland, O., is preparing plans with a view to making a large addition to its plant.

The Wisconsin Electric Light and Power Company, of Milwaukee, Wis., will build a factory for the manufacture of dynamos at Layton Park.

It is reported that the Missouri, Kansas & Eastern Railroad Company will build a roundhouse and repair shops at St. Aubert's, Mo.

It is said that the capital stock of the Hyer-Sheehan Electric Motor Company, of Stafford, Conn., has been increased from $2,500 to $3,000.

The foundry of Brown & Sharpe Mfg. Co. started August 14, after the usual vacation, and all departments of the machine shops resumed work August 28.

The Toledo Bridge Company, of Toledo, O., is putting up a 90x250-foot addition to its plant, which will be equipped with machinery for structural iron work.

The Bothwell Compressed Air Improvement and Construction Company, of New York, has been formed. The directors are W. T. Bothwell and others.

The County Commissioners of Thomaston, Ga., have decided to erect a new bridge across the Flint River, and will have plans, etc., prepared in a short time.

Shortly after September the new Gould Car Coupler Works at Depew, near Buffalo, N. Y., will be ready for business. Some 500 men will be employed at the outset.

Ground has been broken at Olneyville, R. I., for the new plant of the Diamond Machine Company. The building will be of brick, 140x60 feet in size, and three stories high.

Whispell & Denby, at Norfolk, Va., intend to add an 80 horse-power boiler to their saw-mill plant, and will also put in a fire pump and a three saw gang edging machine.

An addition is being made to car shops at Elkins, W. Va., for the purpose of increasing the manufacturing facilities. The addition will nearly double the size of the plant.

Klug, Baches and Stoll, of Milwaukee, Wis., will soon begin the erection of a brass foundry. The dimensions are 40x80 feet, with a brass finishing shop 40x100, and a pattern shop and boiler room 30x62 feet.

The Portland Ammoniate Co. has been organized at Portland, Me., for the purpose of manufacturing fertilizers with $250,000 capital stock. The officers are: President, Ed. C. Hersey, of Portland; treasurer, Wm. E. Perkins, of Deering.

The Gibson Iron Works, of Gibson City, Ill., recently incorporated, will erect, the coming fall, two buildings of brick and iron, 50x120 feet each, for the manufacture of hot water and steam radiators and for general machinery work.

The new addition to the Billings & Spencer Company's machine plant, at Hartford, is rapidly nearing completion. The building will be used for the manufacture of small wrenches, as a drafting-room, and for counting-room accommodations.

The Interchangeable Tool Company will locate at Utica, N. Y., and has obtained land upon which to erect a plant. A factory 200 feet long and 50 feet wide will be built. It will be in operation by January 1, 1894, and about 150 men will be employed.

The Pennsylvania Railroad Company has begun the erection of a building at Washington, D. C., which will be 170x161 feet in size, constructed of corrugated iron, and will admit of 32 cars being repaired at one time; other additions are also to be made.

The Valley Mill, at Youngstown, O., is busy on the improvements at the plant. The foundations for the new 12 and 9-inch mills are completed, and work is being commenced on the new machine shop and blacksmith shop. The repairs are also quite extensive.

A very neat and interesting pamphlet has been issued by the Dodge Mfg. Co., of Mishawaka, Ind. The pamphlet is called a "Souvenir World's Columbian Exposition." Besides some account, with illustrations, of the growth of the business of the company, the pamphlet contains interesting illustrations and descriptions of rope transmissions and other power transmitting devices. The pamphlet is intended for distribution at the Fair but will be sent to any of our readers who send address to the company.

Wm. H. Owen, of Springfield, O., has severed his connection with the Springfield Machine Tool Company of that place, and there has been organized in Springfield, the Owen Machine Tool Company, in which Wm. H. Blee, Geo. Marks and others are also interested. The new company expects to be running its shop within a short time, having leased quarters in a building ready for occupancy.

The Youngstown (O.) Bridge Company is building the largest single pieces of bridge work ever shipped from that city, consisting of three plate girders for Duluth, 86 feet in length, 8 feet deep, and weighing 30 tons each In the construction will be used twelve angles, 6x6 inches, 86 feet long, each weighing 1½ tons, which are among the largest single pieces of angle ever rolled in the United States. These girders will require three flat cars each.

The Hamilton Iron and Steel Company, of Hamilton, Ont., is now being organized. The company intends to erect a large blast furnace at Hamilton. Work has already been commenced upon the foundations of the furnace, which will be 75 feet high and 16 feet diameter at the bosh. The furnace will have a capacity of about 200 tons per day. The company expects ultimately to erect a steel plant, which will be operated in conjunction with its blast furnace.

The Brown-Bonnell Iron Company, at Youngstown, O., is making general repairs at the extensive plant, and nearly all the mills are being overhauled and put in shape. The network of narrow-gauge tracks are being changed so as to make it more convenient to transfer iron from one place to another, and an entire new track is being laid to the new warehouse, the framework of which is now all up. Two large scales for weighing iron have been put in and a large depression in the grounds has been filled.

The D. & H. C. Co. has nearly completed at Oneonta, N. Y., a new brick shop 18x250 feet long, with engine, boiler and coal room adjoining with chimney stack to be 80 feet high (also of brick). It is to be used for mill carpenters' work and car repairs, having three tracks running through its length. Provision is made to take the cars through the shop by means of a capstan and rope, the driving shaft being under the floor. There will be also a traveling trolley with four hydraulic cylinders 18 inches diameter, water pressure 80 pounds per square inch. It will be suspended from the roof trusses, and will be used to raise one end of a loaded car to remove or change its truck. The shops are now working nine hours per day, and are closed Saturdays.

In times like these when almost every manufacturing concern is complaining of hard times and lack of orders, it does one good to find that there is occasionally a concern which is running full time, and has plenty of orders. The Berlin Iron Bridge Company, of East Berlin, Conn., are full of orders, are running their entire plant full time, and portions of their works over time. They have contracts for a large amount of work, including a new electric light and power station at Lynn, Mass.; a drawbridge at Salem, Mass.; a new foundry building for the New Home Sewing Machine Company, at Orange, Mass.; an iron building to go to Tampa, Fla.; a large bridge for Chester County, Pa.; an new iron storehouse for the New York Knife Company, at Walden, N. Y.; a large power plant for the Philadelphia Traction Company, of Philadelphia, Pa.; a large cotton shed for the Southern Pacific Railroad Co., at New Orleans La.; a new roof for the purifier house of the Northern Liberties Gas Company, at Philadelphia, Pa; a new power house for the Reading Traction Company, of Reading, Pa.; a new power house for the State Street Horse Railway Co., at New Haven, Conn.; a car barn for the Easton Transit Company, at Easton, Pa.; a large smelter building for the Anaconda Smelting Company, at Anaconda, Mont. Besides these they have numerous small jobs scattered throughout the country which will employ their entire plant until after the 1st of January.

## Machinists' Supplies and Iron.

New York, August 26, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.00; No. 2, $13.50 to $14.25; Gray Forge, $12.25 to $12.50. Southern brands of good quality are obtainable at $13.75 to $14.50 for No. 1 Foundry; $12.50 to $13.50 for No 2 and $11.75 to $12.50 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10.05c. to 10.10c.; Cookson's, 10.25c. to 10.30c.; Hallett's, 9.75c. to 9.80c., and U. S. French Star, 10½c.

Copper—The market for Lake Copper is weak and dull. Holders are asking 9.55c. to 9.60c. Casting Copper is held at 9¼c. to 9¼c.

Lead—The prices have advanced to 3.55c. and 3.60c. for carloads, and offerings are light at 3.65c.

Lard Oil—Prime City is quoted at 63c. to 65c

Spelter—The market is dull, holders are asking 3.70c; but less would buy for New York delivery.

Tin—Spot tin has advanced to 19¼c, and other deliveries for August and September are held steady at 19¼c. and 19.50c. for October. The demand is slight.

## ✻WANTED✻

*"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Pattern maker wishes position; good workman. C. H. Inman, East Thompson, Conn.

Draftsman & M. E. (graduated in Europe) wishes a situation; good refs. Box 78, Am. Machinist.

Young man wants position as assistant draftsman where he can spend part time working in machine shop. Box 83, Roselle, N. J.

Draftsman (designer), experienced in mach. tools, jigs and general machinery, desires position. Address Box 76, care American Machinist.

Wanted—Situation by first-class mechanic, as general foreman or assistant in general machine shop and first-class engine works; thoroughly understands indicator. J. D., Am. Machinist.

Wanted—Position by tool maker used to universal milling and grinding machines, turret lathes, and the making of tools for the same; setting up and repair of machine tools, shafting, etc.; 12 years' experience, steady. Address Box 77, American Machinist.

Wanted—Position as sup't of boiler works or, will take job laying out; by a man of large experience in handling a large body of men and turning out A1 work at lowest cost; references A1. Address Boiler Maker, American Machinist.

Wanted—Position as sup't, or foreman, by man skilled as such, in gen. machine shop and foundry, 37 yrs. old, 12 yrs in charge of shops, sober, industrious, thorough mechanic, accustomed to contracting, gen. mach'y, steam plants, familiar with foundry. "A. B. C.," care Whitcomb, Mo.

## ✢ MISCELLANEOUS WANTS ✢

*Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.*

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O.

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes & planers. Dietz. Schumacher & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Thousands of tons of machinery molding sand for sale at Geo. D. Slade's, Waterford, N. Y.

Drill press, 38" swing, $75. Turret lathe, $100. Screw-cutting lathe, 18", $120. Box 229, Am. Mach.

Rubber, metal and composition patterns for carding & grouping; small rubber & metal work to order. John T. Usher, 116 E. 54th St., New York.

Will manufacturers of light hardware in Canada send their address to J. H. Logan, Overlook, Dutchess County, N. Y.

We will pay 50 cents each for copies of the American Machinist of December 4, 1886 issue, must be unsoiled and in good condition. American Machinist Publishing Company, 203 Broadway, New York.

For sale—A complete set of patterns for a 12x6 screw cutting automatic cross feed engine lathe, with all modern improvements; easy to build some new features, and a very good tool room lathe; this is a bargain; patterns cost $250; will be sold for $100 cash. W. H. Ermentrout, Reading, Pa.


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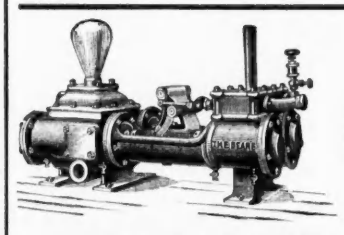
It is a very simple and invaluable little instrument. We sometime ago made some for the use of the machinists who work in our factory, and others who saw them wanted them. So we made up a few hundred, had them nickel plated and put the nominal price of 40 cents (post paid) upon the article. It is as well made as any instrument of its kind and if not satisfactory may be returned. The reason we sell this tool at such a price is in order to bring us into connection with engineers and machinists. This is why we publish our engineering books at cost price, which sell by the thousand.

Address, MASON REGULATOR CO., Boston, Mass.



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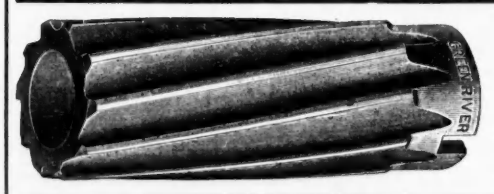

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ENGINE AND SPEED LATHES,
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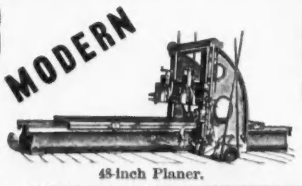
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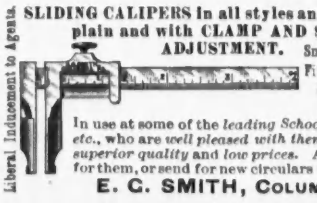

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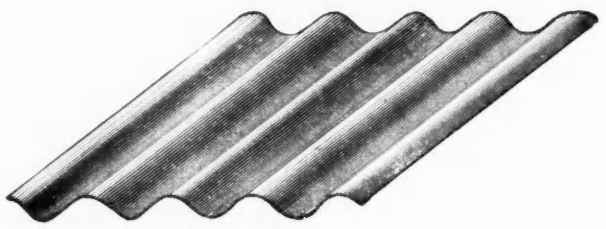

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Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
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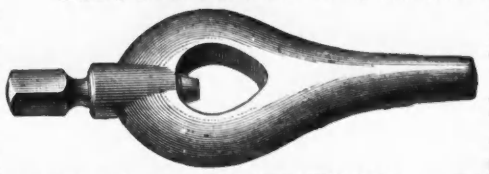

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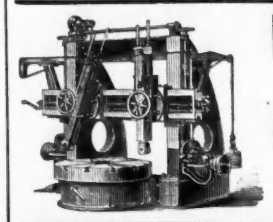

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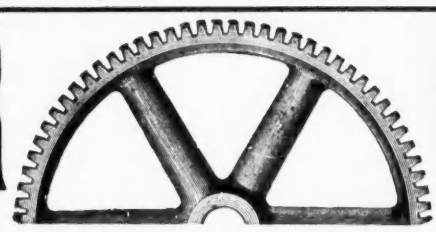

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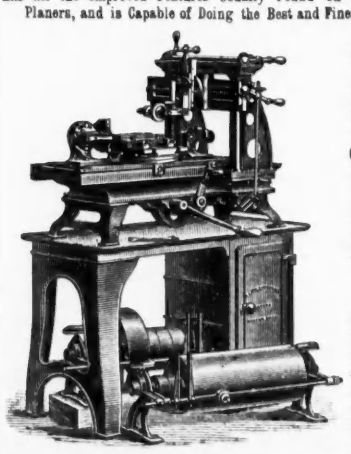

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A First-Class Representative Wanted in the U. S.
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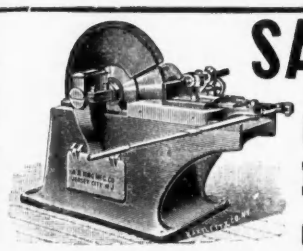

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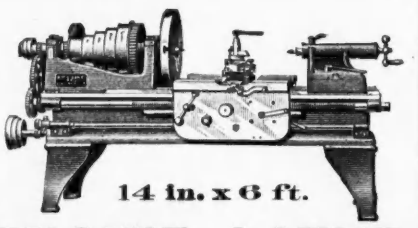

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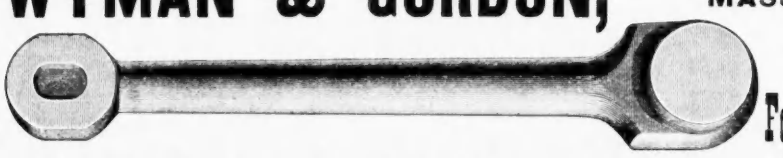

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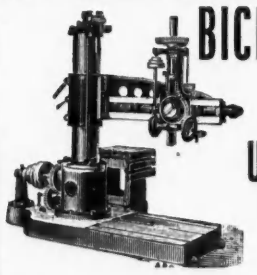

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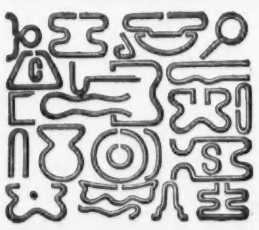

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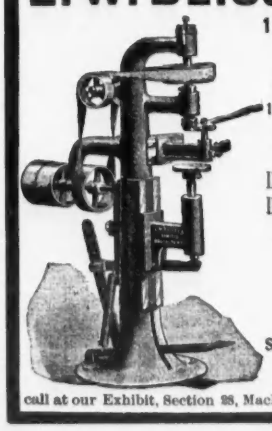

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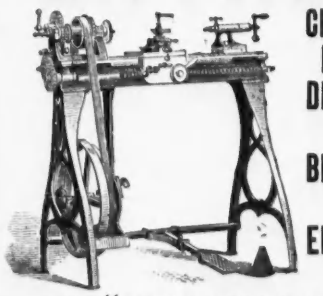

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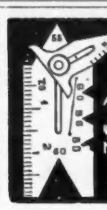

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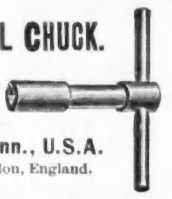
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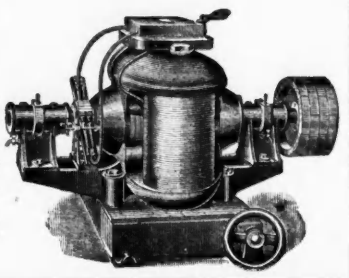

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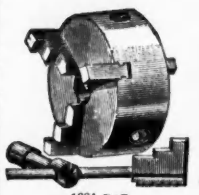
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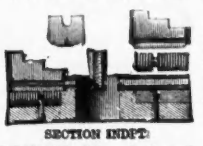
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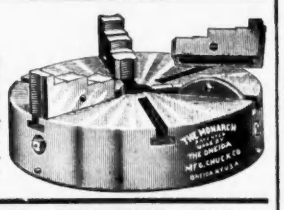

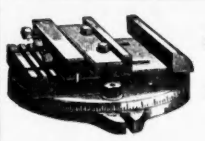
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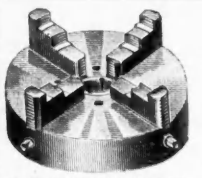
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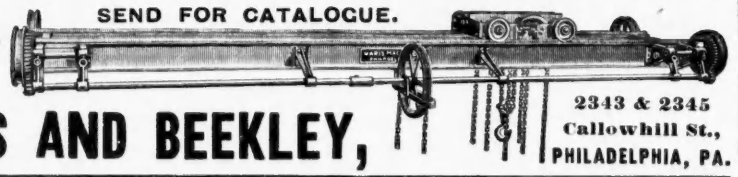
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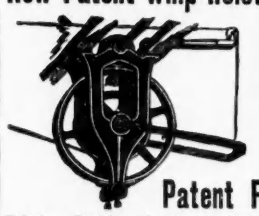
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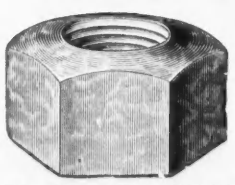
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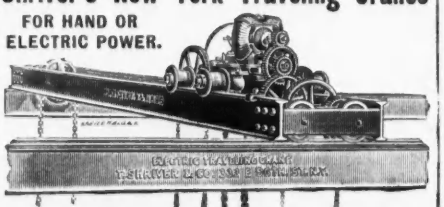
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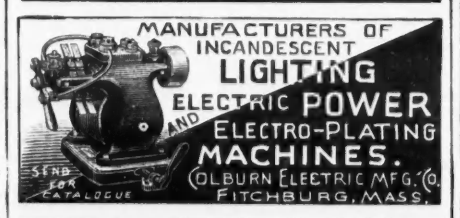
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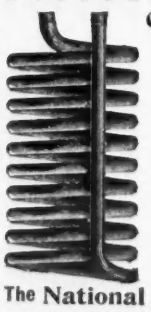
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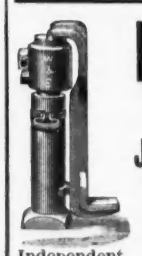
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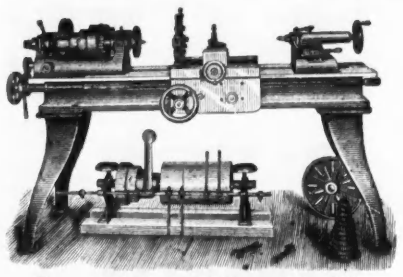

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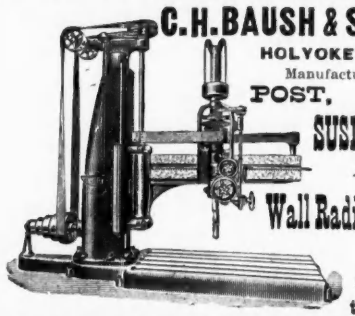

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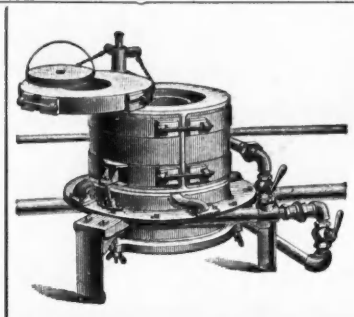

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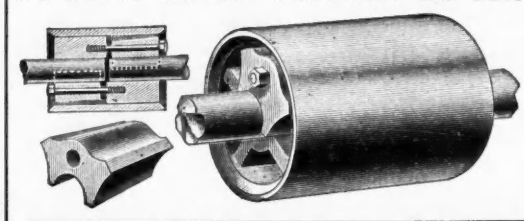

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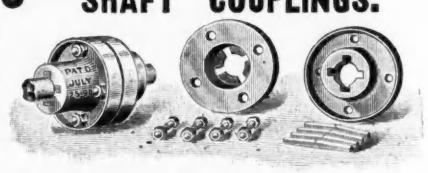

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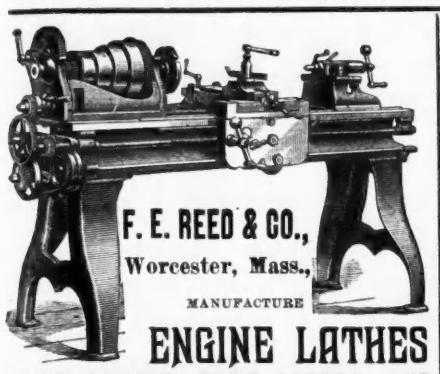

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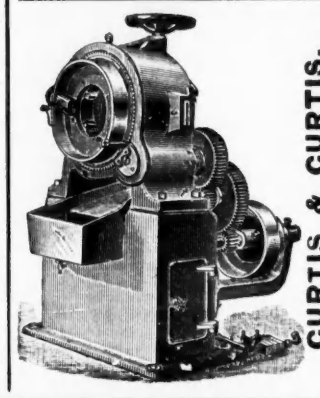

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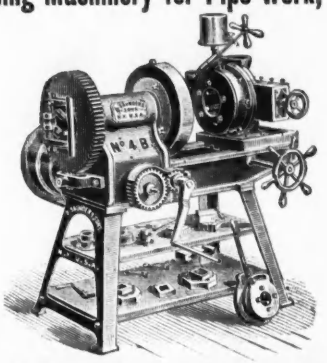

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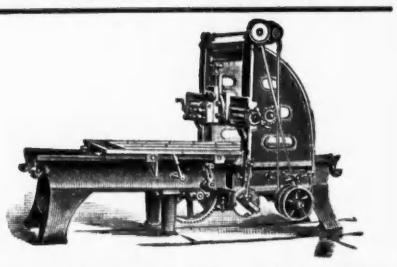

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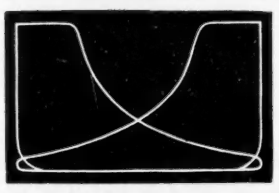

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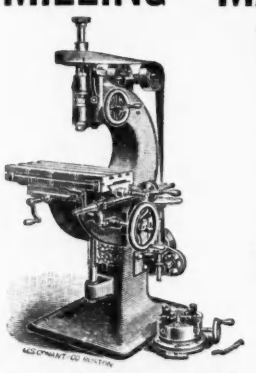

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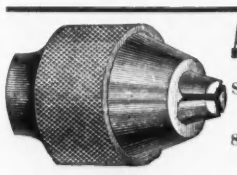

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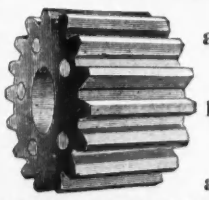

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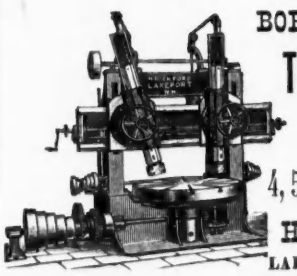

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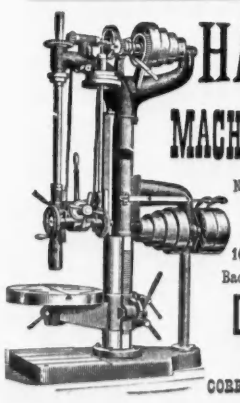

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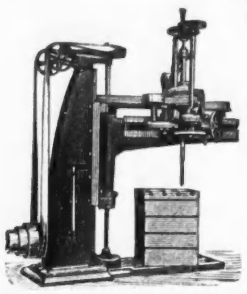

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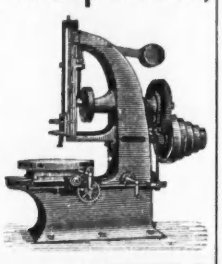

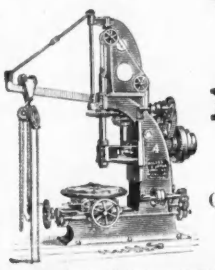

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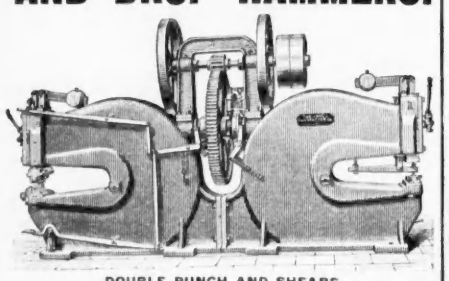

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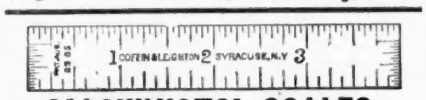


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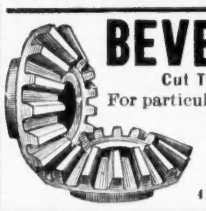

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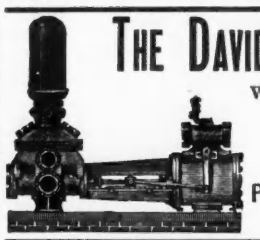

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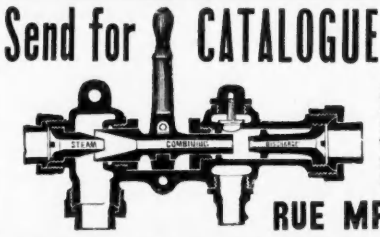


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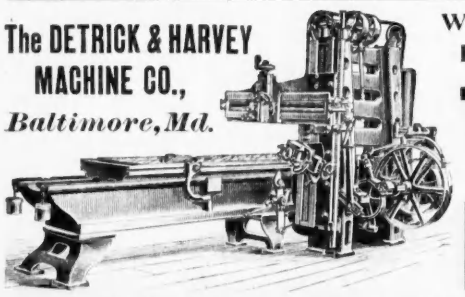

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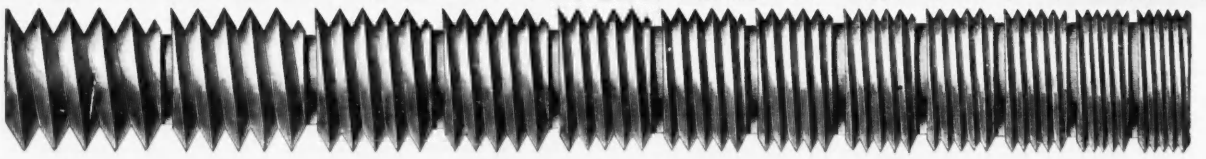

**The above Cut shows 12 Threads from 6 to 20 per inch, cut in**

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They were ALL cut in this Lathe WITHOUT changing gears.

The Lathe was NOT STOPPED during the whole operation.

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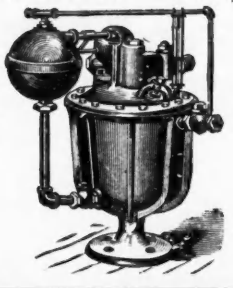

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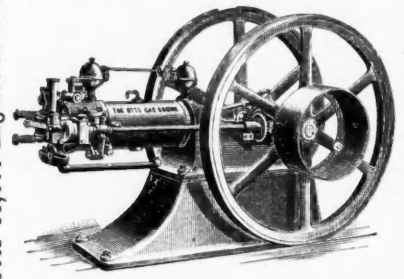

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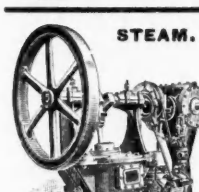

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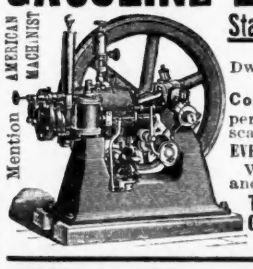


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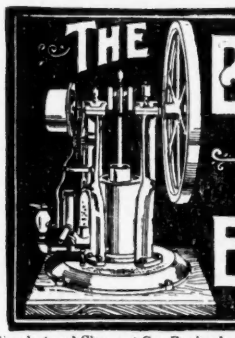

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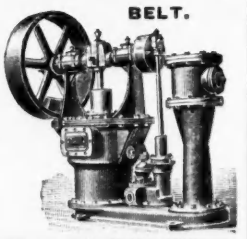

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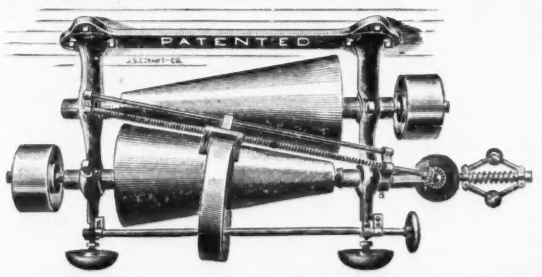


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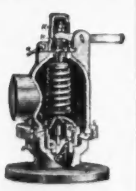

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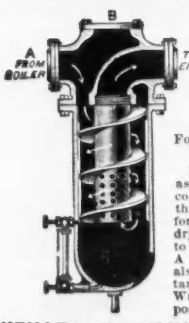


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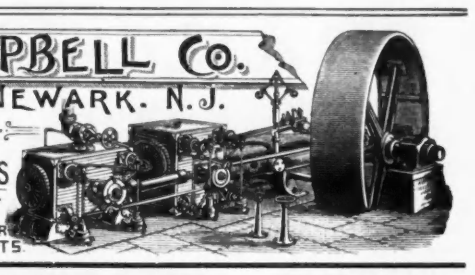

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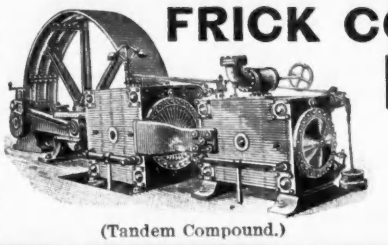

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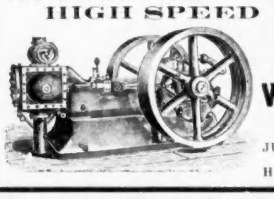

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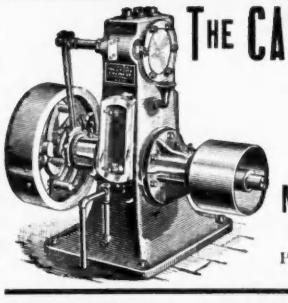

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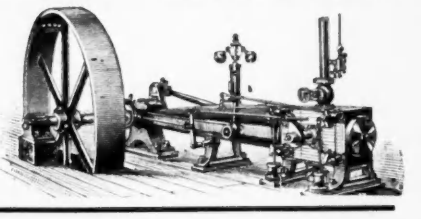

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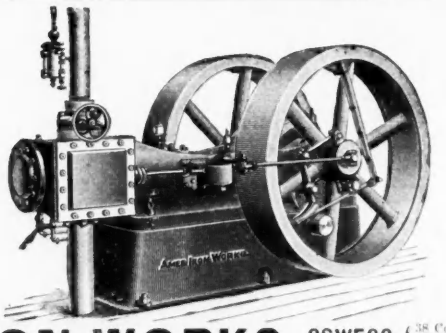

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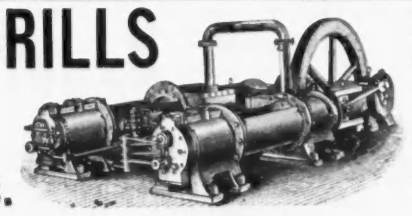

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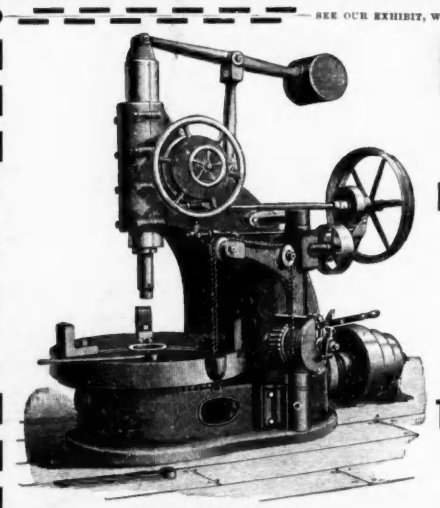

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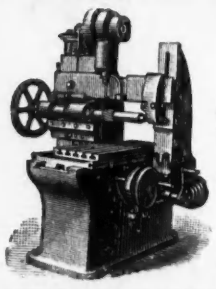

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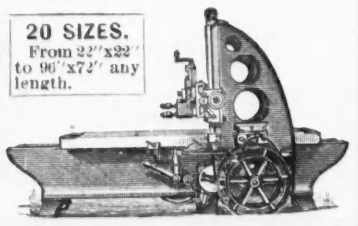

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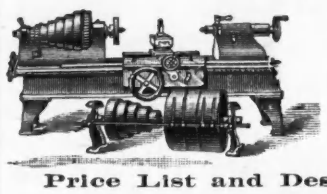

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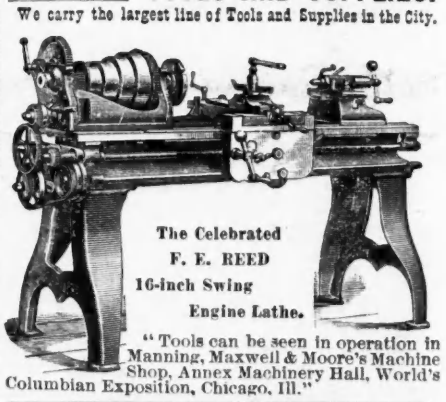

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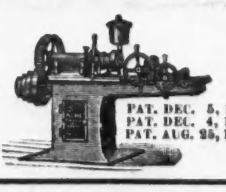


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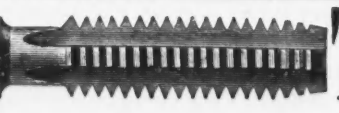
J.M. CARPENTER
PAWTUCKET, R.I.



Manufacturer —of— TAPS & DIES